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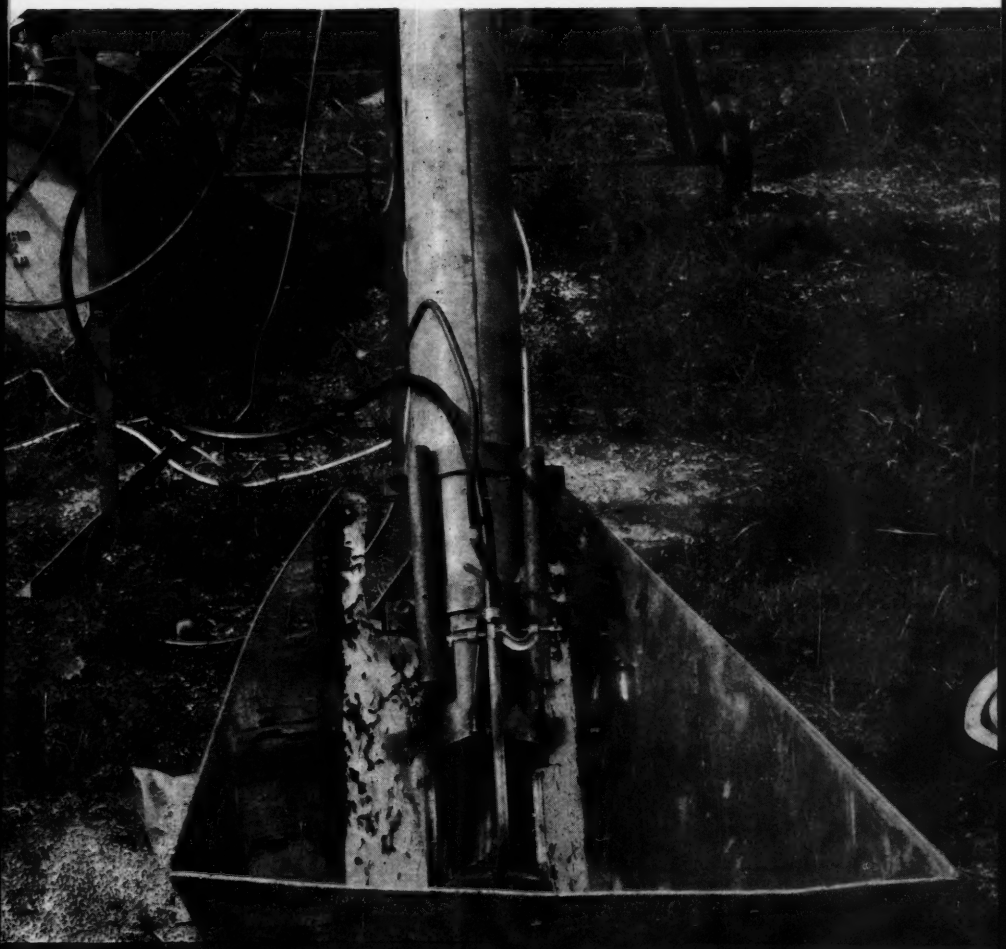

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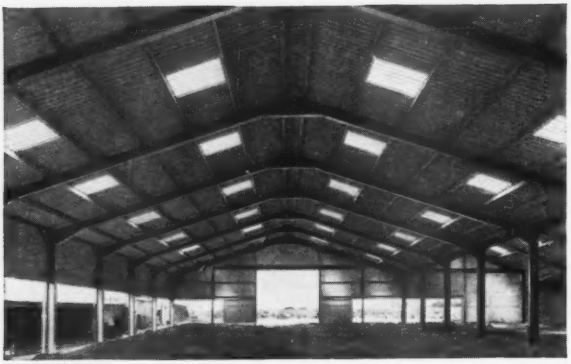

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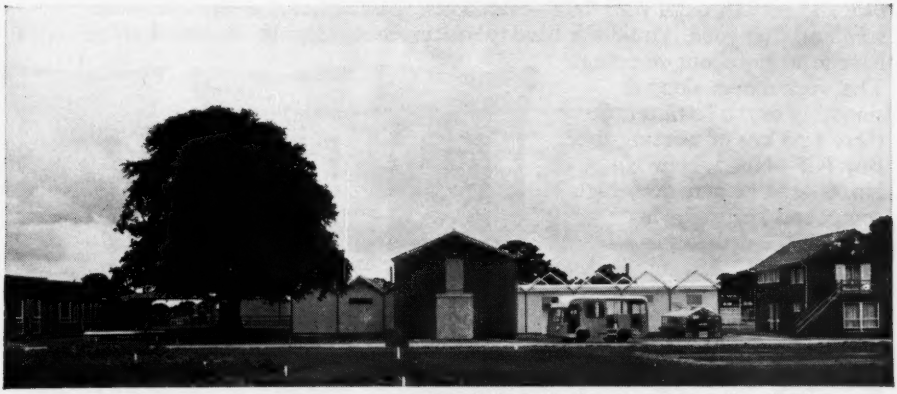

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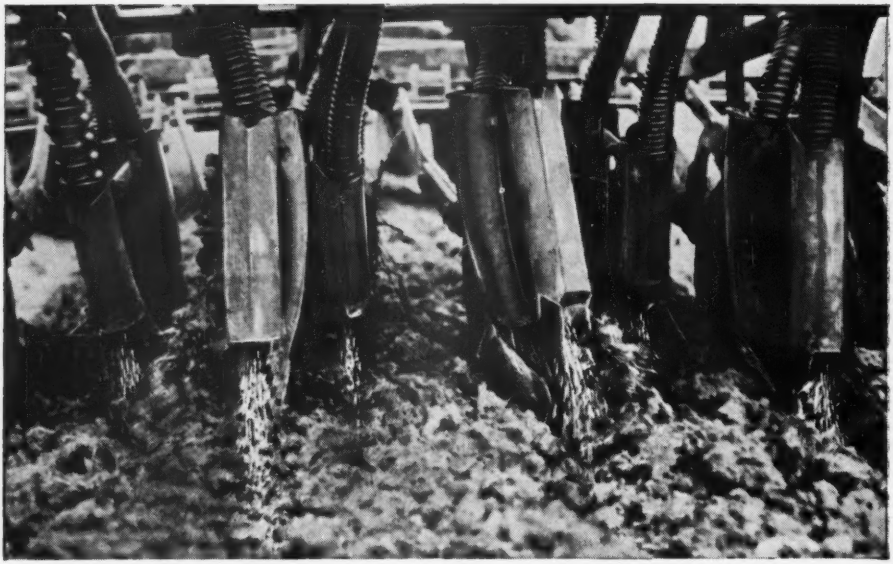

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AGRICULTURE MARCH, 1968

New Farm Improvement and Structure Schemes

M. Madden

THE author of an article 'The Adjustment Process in Agriculture', published in *Agriculture* in December, 1967, described some of the dramatic changes that have been taking place in agriculture over the last 10–20 years. Increased yields, extensive mechanization, changed methods of production, new techniques; all these add up to what is commonly described as the agricultural revolution. The revolution has not, of course, been confined to Britain; the agricultural industries of many other countries have undergone similar drastic changes. This is certainly true of the E.E.C. countries. And in both the E.E.C. and Britain the changes have been accompanied by big decreases in the number of people dependent on the land for their living and steady increases in the total value of agricultural output.

The technological revolution in agriculture has not, however, been accompanied by similarly sweeping changes in the basic structure of the industry, i.e., the total number of farms, and their distribution in size-groups measured by acreage or by volume of business. In Britain and the E.E.C., although there has been a steady decline in the number of farms and a slight increase in their average size, agriculture is basically still in the pattern created in a different era, with a completely different technology and with, particularly in the E.E.C., a preponderance of farms, very small by U.K. standards.

This combination of circumstances has given rise to many problems and the article in the December, 1967 edition mentioned some of them. Two very important ones are, first, the optimum size of unit for different kinds of farming has increased and a great many farmers cannot take full advantage of the techniques and benefit from economies of scale. Secondly, it has become increasingly difficult for farmers on very small units to maintain a standard of living at a level which most people in Western Europe today would regard as minimal. Faced with this situation, and sometimes prompted by political pressure from farmers, governments in a number of countries have introduced measures designed to improve farm structure and encourage capital investment and greater co-operation both in production and marketing in farming.

The measures being taken in the E.E.C.* include loans and cheap credit for purchasing land for amalgamations; grants on improvements and to farmers who leave their farms so that they can be amalgamated with others; re-training and re-settlement facilities; and arrangements for the state to purchase land for the enlargement of farms if the owner is prepared to sell voluntarily.

The E.E.C. countries introduced most of these measures during the late fifties and early sixties. This was when Britain's first grants to aid structural reform also appeared. State assistance for farm amalgamations was provided for in the 1957 Agriculture Act, Section 16 of which enabled grants to be paid amounting to one-third of legal, survey and similar expenses incurred in carrying out an amalgamation. The same Act introduced the first Farm Improvement Scheme which made available grants of one-third of the cost of certain improvements for the long-term agricultural benefit of land.

Although over the next eight years the Farm Improvement Scheme proved an outstanding success very few amalgamation grants were paid. Total expenditure to the end of October, 1967, was under £6,500 and a good deal of that money was spent on one scheme, the now famous Vaynol Estate amalgamations (see *Agriculture* August, 1965).

By 1964 most of the money allocated for the first Farm Improvement Scheme had been committed and it was decided to introduce a revised scheme. Then, in the White Paper *The Development of Agriculture* published in August, 1965, new schemes for improving farm structure were announced. All these provisions were included in the Agriculture Act 1967 which came into force in May, 1967. The new Farm Improvement Scheme began operating straight away but the farm structure provisions had to be set out in detail in statutory schemes. These came into operation on 31st October, 1967.

Farm structure schemes

The measures aimed at improving farm structure are in two schemes; the Farm Amalgamations and Boundary Adjustments Scheme and the Farm Structure (Payments to Outgoers) Scheme. Between them they make available grants of 50 per cent of the costs involved in carrying out an amalgamation and either lump sums of between £1,000 and £2,000 or annuities of between £200 and £275 to small farmers (either owner-occupiers or tenants) who give up their farms for them to be joined to other farms in approved amalgamations.

The schemes are complex and anyone interested in taking advantage of them would be well advised to contact his nearest Ministry divisional office before making any moves to amalgamate or to vacate his farm. But a brief description of the main provisions will give some idea of the type of proposals that might qualify.

The amalgamations scheme offers grant towards expenditure incurred in enlarging a unit and in rationalizing farm boundaries. To be eligible for amalgamation grant a farmer must either take over an 'uncommercial unit' and add it to his own farm or if his own farm is an 'uncommercial unit' he must add more land to it. In both instances he must produce a 'commercial

*Articles in the April and September, 1966, editions of *Agriculture* described the E.E.C.'s agricultural structure policies.

unit'. Commercial unit and uncommercial unit are defined in the scheme. A commercial unit is a farm capable of providing work for a total of, on average, at least 600 days a year for the occupier and one other man. An uncommercial unit is, of course, smaller than a commercial unit but capable of providing work for the occupier for an average of at least one hundred days a year. In assessing both types of unit it is assumed that the management is reasonably skilled, that a system of husbandry suitable for the district is followed and the greater part of the feedingstuffs required by livestock kept on the unit is grown there.

It is recognized that the smallness of farms in certain areas makes it difficult for amalgamators to achieve full commercial standard in one step. An amalgamator may, therefore, in certain circumstances form an 'intermediate unit'. This is a farm capable of providing work for one man for an average of at least 275 days a year, making the same assumption as to the standard of management, the system of husbandary followed and the amount of feedingstuffs grown.

Transfers or exchanges of agricultural land which give more satisfactory boundaries to one or more agricultural units may also be grant aided at the same rate.

Proposed boundary adjustments and amalgamations must satisfy certain tests—somewhat similar to those in the Farm Improvement Scheme—of their prudency, reasonable cost and effectiveness. An amalgamation which results in an intermediate unit must pass additional tests to show whether it would be expedient as a step towards the eventual formation of a full commercial unit.

If an amalgamation or boundary adjustment satisfies these requirements, grants at the rate of 50 per cent of approved expenditure is payable on the incidental costs (legal and survey fees, stamp duty, etc.) and on any work or improvements—remodelling works—necessitated by the amalgamation or adjustment. A wide range of work and improvements is eligible. The full list and details of the scheme are given in an explanatory pamphlet (AB1) available from any of the Ministry's divisional offices.

Conditions will be applied to farms amalgamated with the aid of grant to prevent them being split up again or used for some purpose, other than agriculture, for forty years, unless the Minister consents to this happening.

In addition to grants, the Act makes available to amalgamators loans to cover the expenses of buying the land and carrying out the amalgamation. Small farmers can get 100 per cent loans, larger farmers 90 per cent loans.

The basic requirements for any farmer who wishes to take advantage of the grants available under the outgoers scheme are that he must occupy an uncommercial unit, defined as in the amalgamation scheme, and that he must give it up for it to be added to another unit. The amalgamation must be one which qualifies for grant under the amalgamation scheme, or, alternatively, a farmer may sell his farm to a Rural Development Board, if there is one, or to the Government. The power for the Government to buy the land will be used only when no private buyers are interested in acquiring the unit for amalgamation purposes.

To prevent speculative buying by people who might wish to benefit by the outgoers grant, a prospective outgoer must have occupied the farm he wishes to quit since 4th August, 1965, the date the farm structure proposals

were first announced. If he did not occupy the farm on that date but since then has inherited it, or acquired it on transfer from a member of his family, he may still qualify provided that it has been handed on to him from the occupier in August, 1965, in one or both of these ways.

The scheme requires an applicant to satisfy an income test to show that he depends mainly on the unit for his livelihood. A farmer can meet the requirements of the test if he obtains no more than £400 of his income from sources other than the farm, in which case it does not matter how much income he gets from the farm. But for every £1 over £400 that he obtains from outside sources he must earn £3 from the farm. If the farmer is married his wife's income is also taken into account. So, if his wife has a job in which she earns £500 a year, to satisfy the income test the farmer would need an income of £300 a year from the farm, giving a total joint income of £800 a year. The test will be applied to any year in the past five which gives a fair indication of the normal amount of farm income.

A farmer who meets the requirements of the scheme can qualify for either a lump sum or an annuity. The first is offered to farmers under 55 years of age, the second to farmers aged 65 or over. Farmers aged between 55 and 65 may choose either. The amount of the lump sum is £1,000 for farms of up to 10 acres increasing, at the rate of £10 for each acre after the first 10, to a maximum of £2,000 for farms of 110 acres or more. The annuity is £200 for farms of up to 10 acres increasing, by 15*s.* for each acre after the first 10, to a maximum of £275 for farms of 110 acres or more. The surviving husband or wife of an annuitant farmer is eligible for an annuity of half the amount of the original.

A farmer can qualify only once for an outgoers grant, but if he takes the lump sum he is free to return to farming if he wants to. If he takes the annuity he must not have his own farm again though he may keep a few animals or grow a small area of crops.

Both the schemes will be operated on a voluntary basis and no pressure will be brought to bear on farmers either to increase the size of their farms or to give up farming.

Farm Improvement Scheme

The farmer who wants neither to amalgamate nor to leave his farm can qualify for grant on certain improvements under the new Farm Improvement Scheme. The new scheme is identical to the old one in providing grant to assist in the making of long-term improvements for the benefit of agricultural land. The rate of grant is lower—25 per cent instead of 33⅓ per cent—but it is payable on a much wider range of improvements. Moreover, 'long-term' is now taken to mean a period of at least ten years instead of, as under the old scheme, at least fifteen years.

The main additions to the list of eligible improvements have been of fixed plant and machinery and so far these have accounted for almost one-quarter of the grant paid. Another addition is silos, following the discontinuation of the Silo Subsidies Scheme. The full list of eligible improvements and other information about the scheme are given in an explanatory leaflet (F.I.1) available from the Ministry's divisional offices.

Under the Agriculture Act 1957 the sum of £90 million was made available for the old Farm Improvement Scheme; the 1967 Act has added a further £80 million to the kitty to be paid out under the new scheme.

The requirements of the new scheme are very similar to those of the old scheme. An improvement must be for the benefit of land which is, or will be after the improvement has been made, capable of providing an occupier, reasonably skilled in husbandry, with a sufficient livelihood, and the cost of an improvement must not be unreasonably high in relation to the benefit to be derived from it. A change has, however, been made in what is popularly known as the 'prudent landlord test'. This has now become a test of whether a prudent owner-occupier would be willing to make the improvement having regard to its cost and all other circumstances but disregarding benefits derived from the improvement other than the benefit in farming the agricultural land. The change has been made to reflect the tendency in the industry to owner-occupation but it also broadens the test so that the sort of improvements that a tenant might make without compensation can now qualify. These include, of course, fixed plant and machinery.

Under the old scheme most grant in England and Wales was paid out on buildings for grain and fodder storage (31 per cent), dairying (21 per cent) and cattle rearing (18 per cent). While the new scheme is not directly comparable to the old because of its wider scope the same sort of improvements are still predominating.

Under the old scheme improvements benefiting 68 per cent of all agricultural land in the United Kingdom were grant aided. To judge by the rate at which applications for grant are currently being received the new scheme promises to be equally successful.

These three new schemes will provide the agricultural industry with a great deal of capital. It has been estimated that in Britain as a whole the structure schemes could eventually cost between £15 and £17 million a year while farm improvement grant is being paid at the rate of £12 million a year. This rate of investment is bound both to bring about changes and to help some of those changes already taking place. The general aim is to make the industry healthier and stronger to face the future. This is an important task in its own right but it will become especially important if Britain should join the Common Market.

This article has been contributed by **M. Madden,** who is a Principal in the Land Improvement Division of the Ministry of Agriculture, Fisheries and Food.

Binder for 'Agriculture'

As a result of a keen interest shown by many of our readers in purchasing a binder to hold their copies of 'Agriculture', we are now pleased to say that such a binder is now available.

The binder comprises two stiff covers bound in dark green material and joined together by a spine covered in similar coloured leatherette on which the title 'Agriculture' is embossed in gold lettering. It holds twelve copies of the journal.

The price of this binder is 12*s.* 6*d.* (by post 13*s.* 8*d.*) and is obtainable from H.M.S.O., P.O. Box 569, London S.E.1, Government Bookshops (*addresses on p. 150*) or through any bookseller.

Unloading colonies of bees for work in beans. Hives being placed at intervals through the crop

Bees and Agriculture

Paul Wix

AT the present time there are in England and Wales 39,122 known beekeepers controlling 182,254 colonies. The control of the majority of colonies rests in the hands of 'hobbyists' as indicated by the following Ministry figures:

England and Wales 1946, 1962.1966 (estimated 75 per cent of total)

Number of colonies	Number of beekeepers					
	1946	1962	1963	1964	1965	1966
1— 10		44,444	41,407	41,213	39,543	36,012
11— 39		3,109	2,756	2,918	3,007	2,795
40—100		284	248	244	261	237
Over 100		86	74	83	84	78
Total beekeepers	83,444	47,923	44,485	44,458	42,895	39,122
Total colonies	407,279	228,496	192,652	201,564	198,777	182,254

The decline in numbers between 1950 and 1962 was mainly due to the fact that when sweet stuffs came off the ration many people who had taken up the hobby during the war years ceased to keep bees. Adverse weather conditions and changes in agricultural practice have caused the recent decline in some of these numbers.

The majority of beekeepers produce honey for home use but in good years the surplus is distributed at the gate, through local retail outlets or in bulk to the wholesale trade. The uncertainty of the British climate suppresses the growth of large commercial units and commercial operators often blend or pack local surpluses and overseas honey to ensure a livelihood. It is of some pride to beekeepers that they survive as an example of 'cottage' food production, but the amateur status of beekeeping has caused difficulties that are hard to resolve with current agricultural practices. The beekeeper rarely exercises control of the land over which his stock forages and the likelihood of a honey surplus depends on the availability of forage within range of the apiary, coupled with suitable climatic conditions for nectar secretion and colony development. Honeybees will forage for distances up to three miles but most beekeepers look to the potential of the 2,000 acres within a mile radius of the apiary. In theory each hive needs four acres

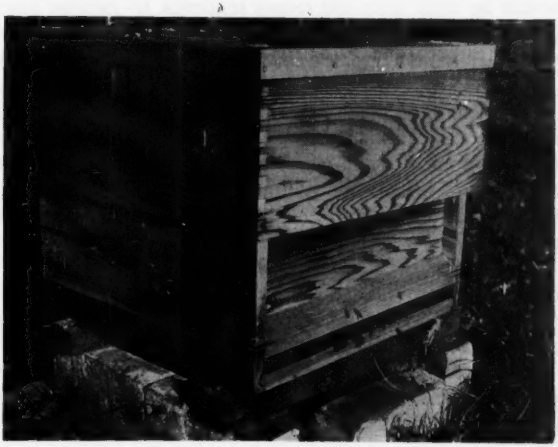
of nectar bearing crops to ensure a surplus and 50 hives is an often quoted maximum number to site in an apiary. Fifty hives need 200 acres of good concentrated forage or alternatively they range less effectively over the whole area. In practice, many districts will no longer support 50-hive apiaries and, as most beekeepers like their stock to hand, they are reluctant to set up out-apiaries.

Yearly changes in the cropping pattern of a district complicate calculations and lead to minimum stocking. The beekeeper is never able to say in advance which of the available flowering crops will yield nectar in any year.

Pollination and insecticides

English honey accounts for about 20 per cent of the total consumed. Apart from honey production, the main value of bees lies in their efficiency as pollinating insects. In trying to assist growers many beekeepers have lost stock through the incorrect application of insecticides. Orchard growers have, over a period of years, reached a spray programme in sympathy with beekeeping practice. Fruit trees need bees early in the season, before most wild bees have recovered from winter hibernation and are present in sufficient numbers to be of value in the pollination of large orchards. A clear example of this problem followed the winter of 1962–63 when package bees were imported to cover winter losses and assure the early season pollination programme. The climate during fruit blossoming is notoriously fickle and the limitation on pollination, assuming sufficient bees are present, is set by the weather. The open structure of fruit blossom allows pollination to take place during the nectar gathering process and the spring period brings a natural demand for both nectar and pollen to supply the needs of the rapidly developing honeybee colony.

For the pollination of crops later in the season a different set of conditions prevail. Temperature is less important and superimposed on the number of bees present is the attractiveness of the particular crop and the physiological state of the colony. Crop attractiveness in terms of nectar production is a physiological problem involving soil type and climatic conditions, while the state of the colony in terms of the amount of brood being reared and



The single-walled Modified National Hive. This type packs well and is used for pollination work

hence the demand for pollen depends on manipulative techniques which have been carried out by the beekeeper. It is apparent that while a colony has an insatiable demand for nectar the pollen demand fluctuates. An understanding of these factors becomes necessary in pollination studies to assess the likely success of a scheme.

The flowering period for beans overlaps other cultivated 'seed' crops as well as a wide range of wild flowers. The bee works on the basis of maximum return for least effort and will collect nectar from sources with the highest sugar content. If rape and beans are flowering in close proximity, the rape will most likely attract the bees due to the easier working conditions provided by the open floral structure. Rape is pollinated during nectar collection while beans, in common with other members of the clovers, are fickle nectar producers and the closed type of flower must be 'sprung' or 'tripped' for pollination to take place. Bumble bees and honeybees can remove the bean nectar through holes bitten in the base of the corolla tube. This act avoids the physical effort of forcing the entry needed to allow the insect to come in contact with the anthers. Pollen collectors set out to enter the flower but nectar gatherers vary and once this behaviour pattern has been developed, individual insects appear to keep to it for their foraging life. If the nectar sugar is low or sparse relative to other available sources, or pollen is more easily obtained or the colony demand for pollen is low during the flowering period, then any one or a combination of these factors may contribute to a low set. Absence of pollinating insects may reduce the bean crop by 30 per cent, make the crop taller by postponing pod set, more prone to lodge in summer and later to harvest. Wild bees will probably pollinate 10 acre areas successfully; with larger acreages a good set may well demand the presence of colonies of hive bees.

Value to break crops

Growers contemplating large scale bean growing could gain from finding colony numbers in range of the proposed crop. Beekeepers could then be informed of aphicide applications to be made during the flowering period. The increased use of prophylactic granular insecticides such as 10 per cent phorate or 7½ per cent disulfoton at 10 lb and 14 lb per acre respectively, would be safer than the recent tendency to gamble against an aphid attack which on occurring necessitates the use of demeton-S-methyl or similar spray materials with a greater risk to beneficial insects. The problem of aerial application of low dose granular materials has not yet been overcome. At present, high clearance tractors are needed for ground application and a 40-ft boom air blast granule applicator which avoids excess passes through the crop is now available. There are signs that the increasing awareness of the value of bees in the pollination of break crops will increase the demand for pollination services and harden the current contract fee of 50*s*. to 60*s*. per colony.

There has been no concerted effort for groups of beekeepers to co-operate to provide stocks for pollination work. The fee must cover the transport to and from the crop and possible loss, although there is the chance of an additional return as honey.

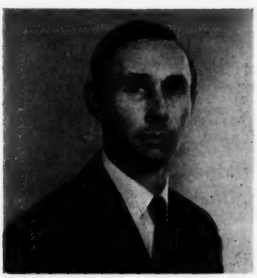
All the crops to which bees can be taken involve some risk of loss. Carpets of dandelions in orchards should be cut before pre-blossom sprays are applied. It is safer to take bees to any brassica crop after the application

of D.D.T. Confinement may be the only practical measure to avoid loss with some methods of aphid control in beans. If aerial application is to be made consideration must be given to the siting of treated crops relative to unsprayed flowering crops, especially clovers. This may in fact require consultation with neighbours. Most of the benefits of pollination services are to the grower; bees rarely come back in a better state than they set off. Movement may well upset the rhythm of the colony and spoil its performance as a honey-producing unit for the season. Growers should be cautioned against buying bees to put down and leave to nature, such colonies may become a hazard to man, animals and a disease risk to other bees.

The willingness of beekeepers to service pollination programmes depends on the efficiency of notification of spraying operations. The success of the following systems varies considerably.

Spraying contractor—Farmer—M.A.F.F. Divisional Office—Beekeepers
Spraying contractor—Farmer—Beekeeper—other beekeepers
Spraying contractor—Beekeeper—other beekeepers
Farmer—Beekeeper—other beekeepers.

These are all imperfect because they assume that all beekeepers in the proposed spraying area are known to the appropriate people and the information is passed quickly enough for action to be taken. The personal approach of beekeepers to their local farmers offers a much greater opportunity for an exchange of information. Beekeepers could also consider an approach to seedsmen to locate growers.



THE AUTHOR

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Herbicides

In the pre-herbicide era, wild flowers in arable and pasture contributed varying amounts of nectar according to the season and the location. The use of herbicides has led to the conclusion that they are a contributory factor in the overall decrease in honey yields. The effects of the various weed control measures are indirect and there is no way of judging the effect on the hive economy and insect health of this loss of flora. History records that on average one year in seven provides the balance between bee, plant, soil and climate that gives a good honey yield in excess of 75 lb per colony; this never makes up for the six poor-to-average years.

In arable areas, charlock provides a concentration of flowers giving a maintenance ration during the traditional hungry gap between the spring and summer flora. Occasionally, it gave a nectar surplus due to the volume of blossom and its loss may have cost the odd good year but more important it has made it difficult for colonies to maintain themselves, and the unprofitable task of feeding up to the main nectar flow has often been necessary.

The use of selective and total herbicides on verges, headlands and hedgerows has added to the toll. There is little evidence that weeds in these locations invade arable land overnight and wild bees have also lost both food sources and nesting sites.

Other agricultural changes

A further limitation on bee forage has been caused by the destruction of hedgerows in field enlargement schemes with a great loss of hawthorn and blackthorn. The reduction in grassland in mixed farming areas and the emphasis being given to cereals has depressed the value of these areas, although break crops may redress the balance. The remaining grasslands are being treated with nitrogenous fertilizers giving increased yields but depressing the clovers. Weed control in grass becomes simpler but the loss of white clover would remove a major nectar source. On the chalk, the nectar producing sainfoin has fallen from favour as a sheep feed.

The balance

The 1967 season has proved good with an estimated production of 3,000 tons of honey, 50 per cent of which may reach the market. Poor weather can thus be blamed for many of the problems of recent years. Strains of bees more suited to low spring temperatures at blossom time are being developed to counter the observation of fruit growers who state that while the flowers are out the bees they hire are not. This type of work is hampered by the importation of package bees to cover winter losses and queens (5,000 in 1966) for requeening purposes.

Many beekeepers would welcome access to flowering crops provided the colonies have protection from toxic substances. The tree-planting schemes which are gaining momentum should include a proportion of nectar-bearing trees such as lime, sycamore and horse chestnut. A surplus of 25 lb of honey per colony is necessary to cover the cost of production and a 40–50 lb average over a seven-year period would be exceptional beekeeping under present conditions.

The series of rapid changes through which agriculture has been passing in recent years have caused bees to work harder to survive, making beekeeping a more expensive pursuit, in fact marginal in some areas. Management has improved and honey yields have steadily fallen. It is not possible to estimate the value of the honeybee as a pollinating agent, but a decline of beekeepers and colony numbers may have serious implications if changes in agricultural practice necessitate large numbers of colonies being available.

Few growers in the 1968 season can hope to use a stocking rate of one hive per acre which, even if rather extravagant by some standards, can be highly desirable in some years.

Sir Richard Haddon

1893–1967

SIR RICHARD HADDON was well known throughout the agricultural world and he was an enthusiastic supporter of the industry during the whole of his long and active life. With the news of his death on Christmas Day many among his very large circle of friends must have paused to think of the variety of activities he undertook so successfully for the direct or indirect benefit of farming and its ancillary industries.

As Managing Editor and later Chairman of the *Farmer and Stockbreeder* he carried quite a heavy responsibility, but somehow he found or made time to take part with other kindred spirits in many important activities outside his main work. It was certainly no accident that he should have become involved in this way. It was what he himself wanted; and in any case it was quite inevitable because of the valuable contribution he could always be relied on to make on account of his widespread and influential contacts, his ability to think up and develop novel ideas, and his capacity for getting things done either by his own efforts or by those of others who were fired by his infectious enthusiasm.

During the last war Sir Richard was the driving force behind the Red Cross Agricultural Fund, which raised over £8 million for the Red Cross; and along with his associates in that effort he later took a prominent part in the successful launching and running of the Worshipful Company of Farmers. As Chairman of the Livestock Export Group he did much to promote the export of livestock in the early post-war years; and by taking the lead in forming the Guild of Agricultural Journalists it was his satisfaction and pleasure to improve the status of the group of journalists with whom he was closely associated for the whole of his career.

A full catalogue of all his achievements would be a lengthy one, but in this Journal it is necessary to emphasize more particularly the invaluable help he gave during a period of well over 20 years to successive Ministers of Agriculture, and to the Ministry. When war threatened it was realized that it would be vital to increase the production of food here at home. And it was clear that good publicity would be essential for putting agricultural policy across to the industry and explaining how best the food-producing campaign could be implemented. The Department obviously needed help in this work, for publicity was not a strong card in the hands of the pre-war Civil Service.

Richard Haddon was at hand, and he was the obvious choice for Chairman of the Publicity Advisory Committee appointed by successive Ministers from 1939 onwards. With his friendly approach to all concerned, his first-hand knowledge of Press needs, and his readiness whenever necessary to

put in long hours of hard work alongside the Ministry's Press and publicity staff, he succeeded in putting the Department's information services on a sound footing; and it was largely due to him that, in the field of agriculture, Fleet Street and Whitehall established and maintained the best of relations.

Special mention must also be made of the highly successful 'Dig for Victory' campaign in which Sir Richard took a close personal interest and often an active part. He was every bit as enthusiastic about the plan for producing food on allotments and in gardens as he was about the major food production campaign.

For all his voluntary national service he was made C.B.E. in 1944 and awarded a Knighthood in 1951. These honours were richly deserved, and to him and his friends they gave great pleasure and satisfaction.

RICHARD MANKTELOW

Members of the N.A.A.S. Work Study Unit investigating the harvesting of strawberries discuss the progress in the use of tray carriers

Harvesting of Strawberries

W. J. Mattingley

AROUND the year 1900 strawberries in Kent were picked before dawn to get them to the London markets by mid-morning. The pickers were paid 4*d.* a peck for their efforts before 6 a.m. and 3*d.* a peck afterwards. One man is recorded as having picked 14 pecks (168 lb) before 7 a.m. The normal drill was to be on the field before dawn, start picking at the first signs of daylight and go on to breakfast time (about 7 a.m.). Usually picking stopped then until about 2 p.m. when it would be resumed and then continued until 7.30 p.m. or later. There was a tremendous surge of acreage in the late 1800s both nationally and in Kent, and in 1889 George Bunyard, writing to the Royal Horticultural Society, mentioned a grower in the Swanley area who had at that time 2,000 acres!

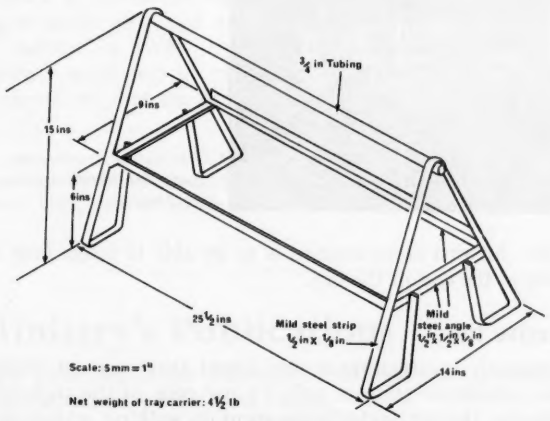
We no longer think in terms of this acreage, indeed, 100 or even 50 acres of strawberries require a considerable labour force and much attention to detail in organizing it.

Labour and its management for picking is perhaps one of the prime factors in this crop, and whilst it was no doubt an important item in the past, despite its abundance, under present-day conditions it has become increasingly important with a very much smaller source of casual labour and the emphasis more and more on quality fruit in the shops.

We no longer think of the 'peck' as a unit for the picker, and indeed, the whole concept must have changed radically since those far-off days, but nevertheless it is a fact that workers will continue to do a job using the same methods until someone seriously considers lessening the load by making the job easier or quicker or both. This has been the case in the harvesting of strawberries; the pattern has been dictated by tradition and also to some extent by the growth and vigour of the plants and by row widths.

Departing from tradition

With modern varieties, cleaned up for virus, the resulting plant is large and on standard row widths of approximately 3 ft, there is little room for the pickers' feet as well as a picking tray in the rows. In 1967 there was a definite swing away from tradition, an increasing number of growers looked at harvesting and some very interesting developments took place. The narrow 'field carrier'—a long narrow rectangular box holding from 12 to 14 × ½ lb punnets is being superseded by metal tray carriers which (against all tradition!) are not placed in the alleys, because they are too big, but 'straddle' the fruiting rows.



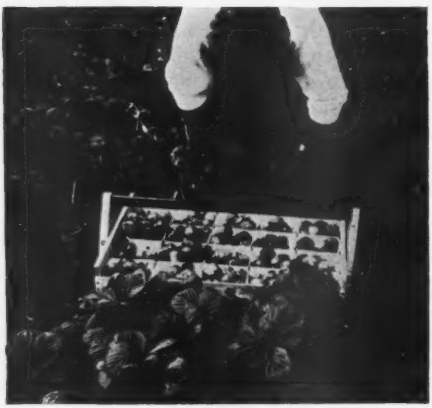
A drawing of a metal tray carrier

An investigation* by the N.A.A.S. Work Study team, into strawberry harvesting was started in Kent in 1964, and many facts have been revealed. Foremost among them was the time taken to transfer punnets from the field trays into the market containers. On holdings where this method is

*An investigation into the harvesting of strawberries, Kent 1964, 1965 and 1966. Final report by C. Ellis, D. Mellard, J. Pearce (Work Study Unit) and W. J. Mattingley, Horticultural Adviser, Maidstone.

used the procedure is for each picker to take two (or three) field trays filled with empty ½ lb punnets to the picking point, and when the punnets are filled to carry them to the headland and here transfer them to the market trays. The market trays are then carried to a check point for recording and weighing. Several problems arise. Firstly the units are different—12 punnets in the field trays, usually 20 in the market trays which result sometimes in loose punnets being left in the market trays until next time round, or pickers are tempted to put extra fruit in the punnets (over and above the ½ lb) and transfer the extra fruit picked into punnets to make up the market tray. This is bad and results in damage to the fruit. Moreover, the time taken in transferring is considerable. Out of a cycle of 13 minutes for picking and walking to and from the picking position, nearly 2 minutes was taken in transferring filled punnets to the market trays and these figures were recorded on the best pickers; much more transfer time is often taken by inexperienced workers.

The grower is really only interested in getting his fruit off the plants into the market containers in the best possible condition—he pays the pickers



Harvesting strawberries using the narrow wooden field carrier

to pick fruit—his first consideration is to be able to judge how much fruit will be ready at the end of the day.

Unproductive time

In the original investigation it was found that even on holdings where labour was considered efficient only 71 per cent of the pickers' time was truly productive, the remainder being spent on walking, waiting at the check point, transferring full punnets to market trays and refilling field trays with empty punnets. In all work study exercises it is fully appreciated that compensating time must be an integral part of any work cycle: workers must be allowed rest periods to change their working positions. In the case of strawberry picking this is of course essential as workers adopt all kinds of postures when picking fruit. It was agreed, however, that the normal distance of walking and back straightening that takes place in the journey to the checking point should give ample opportunity for a change of position, and even this distance should not be excessive. This means limiting the length of the strawberry rows to 80–100 yards.

Tray carriers

The investigation was continued in 1965 and 1966 and the final report by the workers concerned has been published by Kent N.A.A.S. The tray carrier referred to earlier in this article has now been tried in considerable numbers on several holdings where 10 acres upwards of strawberries are grown, and where it has been given a fair trial by several hundreds of pickers in the 1966 and 1967 seasons. The report states 'The overall performance per 21 pickers (using the tray carrier) observed in a complete working day showed an average output figure under the prevailing conditions of 2·2 minutes per lb or 82 picker hours per ton. This total time includes filling market trays with empty punnets, walking to and from the picking position, picking and having fruit checked'. These 21 pickers obviously included some slower workers, but it is satisfactory to note that this *average* time (over 21 workers) was better than that achieved in 1964 by two of the best pickers using the field tray and transferring the filled punnets into market trays. These same two women in 1966 using the new tray carrier were able to clip off 0·4 of a minute per lb or a saving of 15 hours per ton of fruit picked, and the punnets were only handled once so damage was minimized! On another farm where the grower was able to organize the filling of market trays with empty punnets in advance, the mean picking time by the best of the pickers showed still more improvement, 1·83 minutes per lb or 68 hours per ton.

The tray carrier at present is designed to hold a wooden tray of dimensions approximately 22½ in. × 15 in. but would accommodate card trays provided care was taken to avoid getting them wet during picking. As this new approach gets under way (and it is anticipated that we shall see more and more tray carriers in 1968) then doubtless there will be modifications. It is now only a small step to include the proposed B.S.I. tray with slightly different dimensions—but the principle still applies.

Acknowledgements

Thanks are due to the Maidstone Soft Fruit Study Group for initiating this investigation, the Work Study Unit, and to the individual growers on whose holdings the studies were carried.

The Ministry's Publications

Since the list published in the February, 1968, issue of *Agriculture* (p. 75) the following publications have been issued:

MAJOR PUBLICATION

Technical Bulletin No. 16. Potential Transpiration (New) 6*s.* 9*d.*
(by post 7*s.* 3*d.*)

FREE ISSUES

SHORT TERM LEAFLETS

No. 14. Chemical Weed Control in Bush and Cane Fruits (Revised)
No. 49. Business Records Leaflet Feed Recording (Revised)

The priced publication is obtainable from Government Bookshops (addresses on p. 150) or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

In the photograph on the front cover the safety guard has been removed to show the simple equipment used for the addition of propionic acid to the grain

Chemical Conservation

R. Bee, *Director, Drayton Experimental Husbandry Farm*

In the old days of horse binder and mower, summer's bounty could only be conserved for winter use by good weather and hard work. Mechanization has since taken most of the physical effort and a good deal of the weather risk out of grain harvesting, silage and haymaking. Will chemicals in future augment mechanization in short circuiting some of the conservation processes involved in crop storage?

A paradox of modern livestock farming has been the necessity to dry grain artificially for safe storage only to dampen it later on to present a more acceptable feed to certain classes of stock. This led to the adoption of 'sealed' tower silos in which damp grain as harvested is preserved in the absence of oxygen and by carbon dioxide. Damp grain has also been successfully stored by chilling. Both these systems however, present some difficulty when warm weather encourages the rapid growth of mould and bacteria still present in the damp grain or by recontamination resulting in quick deterioration as grain is being taken from store and prepared for feeding. Would some kind of chemical treatment by inhibiting this microbiological activity overcome this difficulty?

Preservation by the use of organic acids

Propionic acid has been used in breadmaking for some time as a preservative to extend the shelf life of bread. Three years ago a large chemical and plastics concern were investigating, under laboratory conditions, the possible use of organic acids as a preservative on damp grain. Then a small field trial in 1965 also showed promise and a small number of controlled experiments were conducted in 1966 including two at Drayton and High Mowthorpe Experimental Husbandry Farms. Relatively small quantities of barley, at various moisture contents, were treated at different rates of acid application and these were examined for microflora activity by N.A.A.S. regional bacteriologists regularly throughout long periods of storage up to a year.

The object was to study the preserving action of propionic acid and the possibility of treatment becoming practicable for damp grain storage on

A general view of the use of propionic acid for preservation of moist grain

commercial farms. Bacteria were considerably reduced and also moulds and yeasts greatly diminished at higher rates of application, i.e., 1 per cent acid by weight of grain at a moisture content around 25 per cent. The same effect was shown at lower rates of application e.g., 0·5 per cent coupled with moisture content 18–20 per cent. In spite of the rather persistent odour, acceptability when fed to cattle, lambs and pigs was good and feed conversion rates equal to 'sealed silo' damp barley. Because microbiological activity was inhibited treated damp grain remained free flowing.

In 1967, a wider range of conditions has been covered at 25 locations where nearly 1,500 tons of grain, in quantities varying from as little as 1 ton up to 100 tons in bulk, at moisture contents ranging from 16–30 per cent have been treated. Again experiments have been conducted at E.H.Fs. The major requirement has been to determine rates of acid application tied to grain moisture content required for safe storage under general farm conditions. Again propionic acid appears to have acted generally as a good preservative.

Preliminary observations and experiments have indicated that whereas mites die fairly quickly in treated grain, adult insects are relatively unaffected.

Present indications from these trials and from manufacturers are that propionic acid applied at 0·8 per cent rate will be sufficient for the safe storage of grain at 20 per cent moisture content, costing about 24*s.* per ton. For moisture contents of around 25 per cent, an application of 1 per cent will be necessary at a cost of about 30*s.* per ton.

Up to now acid has been applied by a prototype multiple jet applicator (attached to the base of a grain auger delivering into farm store) and flow being metered by an electric pump, adjustable to the known rate of auger delivery, to give the percentage of acid appropriate to the moisture content of the grain. The experimental equipment is shown on the front cover but more commercial equipment for general farm use is being developed. Spraying of grain being taken up by an auger gives the intimate coverage required.

Concentrated propionic acid is irritative in smell, highly corrosive and splashes of this chemical could cause serious damage to skin and eyes.

By the time the chemical is marketed on a commercial scale, however, techniques of application will undoubtedly have been developed which, in conjunction with adequate safety precautions, will enable the material to be safely handled on the farm.

Future considerations

To date most of the emphasis has been on propionic acid for damp barley storage but formic and acetic acids are also being considered. If equally effective the acid or combination of acids which may ultimately be used will obviously depend on cost. Exposed grain surfaces could possibly be reinfected with moulds during long storage, especially at marginal levels of acid addition. So far however, the preserving effect of acid treatment seems to be quite long lived. As the material is apparently absorbed into the skin of the grain the shelf life between rolling or crushing and feeding of damp grain should be prolonged.

Beans of 24 per cent moisture content have been treated at rates of 0·5 per cent and 1·0 per cent on one E.H.F. but it is too early to state whether these present any special toxins problem due to high protein content. Although damp wheat for feeding on the farm has been successfully preserved with propionic acid, the persistent odour of treated grain will presumably make it unacceptable to the milling trade although compounders might be more interested.

Although propionic acid is a product of ruminant digestion, its feeding value when added to grain for preservation is negligible.

However, the chemical preservation of damp grain as outlined already appears to be an alternative to sealed silos for home feeding. Time will show any corrosive problems in metal bins, equipment etc. Both solid and liquid formulations have been developed in America for grain preservation and these may be marketed in this country, but so far they have not been subjected to trials under our conditions.

Preservation of silage by acidification

One of the most important factors in normal silage-making is the rate at which acidity develops in the mass since this level determines which bacteria dominate the process. *Lactobacilli* can tolerate relatively high concentrations of acid and at these levels of acidity, the growth of undesirable organisms is prevented provided the silage remains airtight. Years of dry matter loss determinations on Experimental Husbandry Farms and elsewhere have clearly shown that by relying on a natural fermentation process to provide the acidity needed to preserve silage, total losses of up to 40 per cent may be involved. Even when this process is very well controlled by excluding air, it seems that losses are still about 15 per cent. Only in completely sealed containers e.g., tower silos, can losses be further reduced. Would direct addition of acid cut out these unacceptable losses associated with fermentation? There is little evidence on this point, even though direct acidification of silage material has been investigated since the latter half of the 19th century and the A.I.V. process has been in regular use for a long time in some Continental countries. Throughout the 1920s and 1930s various research workers formulated mixtures of formic and hydrochloric acid with conflicting results. Later on mixtures based on calcium (or sodium) formate were used to liberate formic acid and more recently proprietary

preparations have been marketed as silage additives both on the Continent and in this country. Still more recently formic acid has been used in Scandinavia (replacing the A.I.V. process) with applicators mounted on to the forage harvesters. It is not known whether the application of formic acid to silage material actually inhibits bacterial activity generally or if the addition of acid merely raises the acidity in which unfavourable bacteria cannot thrive.

During 1967 a commercial firm in this country has supervised the application of formic acid at a number of farms, a limited clearance for the purpose of having been agreed under the Pesticides Safety Precautions Scheme. This is simply and conveniently carried out by a gravity-fed jet beneath a plastic container mounted on the forage harvester, delivering acid at a rate of between 0·2 and 0·3 per cent by weight of grass directly into the throat of the forage harvester chute. Intimate coverage of all the silage material between cutting and loading is thus ensured.

It has been suggested that because of the likely cost of acid in relation to the value of silage its use might be restricted to the outside top layer of silage with, of course, the silo adequately sealed to prevent leaching. This is being studied at one E.H.F. by spraying only one half of the full length along the top of a large bunker silo. At Drayton on the other hand, it was decided to determine the total dry matter losses involved when the whole mass is treated with formic acid. If normal losses were drastically curtailed (by whatever action) then an economy method could be practised later with, of course, a further check on losses involved in that circumstance. If however, little or no reduction in losses occurred by treating the whole mass, then its use on the outside may only be regarded as dubious but would again be checked. At the moment it seems likely that there will not be a highly significant reduction in total losses in this particular case.

However, at least one firm will be marketing a silage additive based on formic acid next year and again we may also see similar material, either organic acids or derivative salts developed in America, being marketed in this country.

Preservation of hay by chemicals

It has been considered that the fungicidal properties of organic acids or salts may be useful in preserving hay stored at higher moisture content than traditionally by inhibiting mould growth and may also reduce the weather risk. As there appeared to be no experimental work carried out in this country on the American developed materials, a small scale trial was laid down at Drayton in the summer of 1967 to assess the ability of selected additives to prevent deterioration of hay baled at 30 per cent moisture content. A small number of bales treated with one of two different proprietary materials, at the respective firm's recommendations, were compared with similar bales at the same time treated with formic acid and propionic acid each at 2 per cent by weight. There were a further few bales of the same material but slightly drier at 23·5 per cent moisture content without additive. Some microbiological examinations at baling and during storage were carried out. Unfortunately, the final assessment will not now be possible as this hay had to be destroyed as a precaution against possible foot-and-mouth disease contamination. Indications of deterioration (some severe) were not particularly encouraging but clearly more work should be carried out.

There is a similar relative attraction, as with grain, in replacing drying either outside or artificially (particularly with high value fodder, i.e., well fertilized grass cut early as for in-barn drying) by chemical preservation.

One wonders if there will be any place for chemical desiccation of crops before cutting for conservation. The chemical desiccants at present in agricultural use are of higher toxicity to mammals than formic, acetic and propionic acids, and their use on crops intended for conservation would have to be notified under the Pesticides Safety Precautions Scheme.

Economics of chemical conservation

At this stage costs of preservatives and application cannot be forecast for all circumstances with any degree of certainty. However, the relative 'on farm' values of the crops involved and the amount of preservative properly required suggests that organic acid preservation of damp grain is a distinct possibility, but preservation by similar chemicals of hay and silage requires far more consideration yet.

Tower Silos

The practice of storing feeding stuffs in tower silos is increasing, and when these have a high moisture content, a number of problems can arise if the moisture content of the material stored exceeds that recommended by the manufacturers of the silos. The Ministry of Agriculture, Fisheries and Food is proposing, therefore, to discuss with the Agricultural Engineers Association Ltd., the feasibility of producing a Code of Practice or British Standard Specification for tower silos. In the meantime, the Ministry recommends that farmers who propose to install tower silos should agree with the manufacturers as to the maximum moisture content consistent with safe storage, and that owners of silos should check them for the following:

1. Undue stress (missing bolts, flaking of vitreous enamel and movement of seams away from mastic packings).
2. Escape of effluent through joints.
3. Corrosion of bolts and fixings.
4. Foundation stability.

The ring shackles of concrete silos are vulnerable to corrosion and should be checked periodically. In all cases, the manufacturers attention should be drawn to defects such as those listed above.

Animal Health and Disease Prevention

This feature on a topical subject contains articles by

★ W. H. Parker, B.Sc., M.R.C.V.S., N.D.A., who is Superintending Veterinary Investigation Officer for Wales.

★ J. R. Hepple, B.Sc. (Hons.), who is head of the Anaerobic Vaccines Unit of Glaxo Laboratories Ltd. at Greenford, Middlesex.

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The author discusses machine milking management in the control of mastitis

Mastitis Control

W. H. Parker

NOT long ago, after I had given a lecture on mastitis to a veterinary audience, a colleague came to me and said 'You are wasting your time'. He was not being rude. Quite the contrary. He meant to infer that very few people, if any, would be willing to approach the problem of mastitis in the systematic and thorough way I had indicated. Such a defeatist view must not be accepted because, for many years now, investigations have revealed that where on a dairy farm a high incidence of mastitis exists this is usually a man-made situation. As would therefore be expected it is also in a high degree a state of affairs which man can prevent. By any reckoning mastitis is far the most important disease condition of dairy cows causing as great a loss nationally as that of several other diseases put together.

Mastitis means inflammation of the udder and for practical purposes this means any diseased condition of the udder. The term can therefore cover a whole variety of diseases. For the purposes of this article the field is narrowed a little by dealing only with mastitis of the milking cow. Leaving aside the nebulous subject of 'sub-clinical mastitis' it is estimated that at least 10 per cent of cows are affected with mastitis annually and the figure can be very much higher—even approaching 100 per cent in some herds.

Cases still as common

Up to the year 1946 when penicillin became available for veterinary purposes the main form of mastitis was a slowly-developing condition which spread insidiously through the herd chiefly on milkers' hands, udder cloths and the milking machine units. The germ responsible, *Streptococcus agalactiae*, is highly susceptible to penicillin which soon caused a rapid reduction of this particular form of mastitis so that it is much less important today. Yet cases of mastitis appear to be as common as ever. Why? It is not due to new germs previously unrecognized, for the germs responsible for most cases of mastitis were recognized as pathogenic before. It cannot be just the use of milking machines for, by the end of the war, most cows were already milked by machine. However, in the ensuing years a sudden change took place in the method of using the machine. At farmers' meetings nowadays smiles of incredulity come over the younger faces when the old method of hand-stripping after machine-milking is described. Everyone now expects the machine to strip the cow and it is well capable of doing so. But

the advent of machine-stripping introduced a new hazard for the health of the udder. That hazard is over-milking and over-milking is the main cause of the continuing high incidence of mastitis in the antibiotics era.

Over-milking is the chief vice of machine-milking. To see it in perspective, milking technique must be viewed with the health of the udder in mind. There are two aspects of machine-milking, the machine itself and the human operator. Both are important.

The milking machine

The most important part of the machine is the teat liner, for this is the only part which comes in direct contact with the cow. If it has a hard mouthpiece or lacks tension it is liable to injure the teat. Inadequate pumps, excessive and erratic vacuum pressure can all lead to mastitis. Fast pulsation rates do harm particularly if a wide ratio is used.

A high degree of inefficiency with consequent udder damage can result from neglect of the milking machine. Frequent regular checking of the vacuum, the vacuum control and the oil is essential. To check the vacuum the gauge is watched when a unit is changed from one cow to another. There is an inevitable fall in vacuum as the change is made but as soon as the unit is again on a cow the gauge should rapidly return to the normal position. If it does not the pump is failing, it is overloaded or there is excessive leakage somewhere in the plant.

The milking machine is used twice every day of the year. It is more frequently in use than any other piece of machinery on the farm except possibly the tractor. Regular testing and servicing of a machine is no more an optional extra than the servicing of a motor car. It is essential for the sake of the machine, the efficiency of milking and the health of the herd.

The human element

Stockmanship is not the elusive quality sometimes suggested. The first essential of a good stockman is his genuine interest in his stock, an interest so absorbing that, like a good car-driver he is (almost unconsciously) making and interpreting observations all the time. Good stockmanship means concentration on the job, care of detail but freedom from fuss leading to confident mastery of the situation. The first job in the milking routine is usually *washing the udder*. This has three purposes: firstly to remove dirt, an elementary job for which water is the chief agent; secondly to remove infection and here the most important consideration is a negative one, namely to avoid carrying infection from one cow to another and this is best achieved by using a fresh paper towel for each cow; thirdly to stimulate the let-down of milk. 'Let-down' is produced by a hormone which circulates in the blood following a stimulus. In a regular routine some standard activity such as the clanking of buckets may stimulate let-down but the most common stimulus is the handling of the udder, so milking should commence within one minute of washing. Let-down does not last long. If milking is delayed it will be inefficient, lead to lower yield and put an unnecessary strain on the udder.

The *rhythm* of the milking routine is simple and sounds very easy but it requires very careful designing and rigid enforcement. The udder is washed

and the machine applied. The milker must be in attendance again in time to reorganize *the end of the main flow of milk*. This is the most crucial point in the milking. At that time the milker should apply pressure to the claw to prevent the machine climbing up the teats and to facilitate machine-stripping, a process which usually need last only about 15 seconds, after which the machine is removed. No massaging of the udder is required.

Over-milking

Over-milking occurs whenever the machine is allowed to continue working on the teats unattended after the main flow of milk has ceased. Anyone unfamiliar with the difficulties of machine milking could be excused for assuming that this was a fault easily avoided. In practice, over-milking is so common that it may be called normal practice in Britain! There are several reasons for this.

The link-up between over-milking and mastitis is not obvious and the farmer is often unaware of the danger. He inherits a tradition from hand-milking which accidentally encourages over-milking with the machine. Abstraction of all the available milk from the udder was a useful rough-and-ready test as to whether a hand-milker was doing the job properly. So a special mythology was built up around the rule that all the milk must be withdrawn. It was alleged without the slightest evidence that if a little milk was left in the udder the cow was very liable to get mastitis and in any case it would start her drying off. These notions have been unquestioningly accepted despite the well-known fact that, only ten minutes after even the best of hand-milking, further milk would be obtained.

The hand-milker, working for the last drop was unlikely to harm the udder. He stopped when milk ceased to come. In the machine age the obsession about the last drop means that the machine is allowed to go on riving the teats when no milk is coming. Furthermore, with many British machines it is very difficult to tell when the main flow has ceased. We can hardly blame the manufacturers for this when few of their customers have understood the need for such facility, let alone demanded it.

Farmers and cowmen must unlearn their mythology about withdrawing the last drop of milk and adopt in its place for machine-milking a new principle. At the end of milking when milk is coming slowly, there is very little left in the udder. To leave a small quantity behind for the next milking does no harm but over-milking is harmful and must not be allowed.

General principles

Circumstances vary enormously on farms—number of cows, type of machine, housing etc. Hence the need to design a routine for each farm and here only general principles can be discussed. The first principle is that no cowman must have so many units to manage that he cannot get back to each cow in time for the end of the main flow. Far too often a milker's capacity is estimated by the number of units he manages. This is often irrelevant. In fact, beyond a quite low figure an increase in units may so reduce efficiency that the milker copes with less cows per hour. Manifestly if, as is often the case, cows are persistently over-milked because too many units are in use, a reduction of units need not increase the time of milking the herd, but it may greatly help in reducing the incidence of mastitis.

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On farms where milking takes place in the cowshed(s) it often starts quite efficiently but very soon the work proves too much and over-milking ensues. This is particularly true where milkers have to work in more than one cowshed. In parlours one of the worst causes of upset to the rhythm is unco-operative cows. No cowman can work efficiently if he has to chase cows into the parlour before milking or out into the yard afterwards. Any extra jobs, fetching food, carrying milk away, feeding calves and so on make the even rhythm of milking quite impossible. So does a visitor who is allowed to distract from the exacting job in hand.

The effect of over-milking on the udder has been cleverly demonstrated by veterinary research workers in California using X-ray photography. Not only is the delicate lining of the teat canal worked upon itself but, because the cluster climbs up the teats, there is a tendency for the still more delicate lining of the cistern above the teat to be dragged into the canal and subjected to the same violent treatment with no milk to act as a lubricant because the passage is now obstructed.

In herds where the incidence of mastitis is very high more than one technical fault is usually involved. Next in importance to over-milking comes unsatisfactory severe teat-liners to which reference has already been made. These are the two most common and most serious faults and they are often found together. As a result of injury the tissue becomes inflamed and inflammation of udder tissue is mastitis. The inflammation may be mild and go unnoticed even though it reduces the potential yield of the cow. However, where injury occurs in a situation favourable to bacteria—and the udder

certainly comes into this category—infection is likely to follow resulting in a more severe condition.

Infection

It is well recognized that bacteria play an enormous part in mastitis, but this very fact tends to make people forget the other factors, which is most unfortunate. We share this world with bacteria and are vastly outnumbered by them. We cannot escape them and a world sterilized of bacteria would be impossible.

Without belittling the importance of preventing the spread of udder infection in every way possible the purpose of this article is to stress that udder injury is also a very important factor in mastitis. The main causes of injury can be prevented by good stockmanship and proper understanding and management of the milking machine.

Restocking after Foot-and-Mouth Disease

Farmers whose stock have been slaughtered because of foot-and-mouth disease are advised by the Ministry of Agriculture, Fisheries and Food to take the following opportunity when restocking.

(*a*) To ensure a high standard of hygiene in the general management of the herd, so as to minimize the risks of loss from disease among the new stock. The measures necessary will vary according to the husbandry on individual farms and the farmer's own veterinary surgeon can advise on this point.

(*b*) To restock in such a way as to make possible the registration of the herd under the Brucellosis (Accredited Herds) Scheme with the minimum delay. The Ministry's local Divisional Veterinary Officer will be pleased to advise on the steps that should be taken to qualify for acceptance into the scheme.

A copy of the leaflet giving detailed advice on these points is available on request from the Ministry's Divisional Veterinary Officer.

J. R. Hepple

Clostridial Diseases

This article describes the nature and control of clostridial diseases of sheep and cattle

THE group of bacteria known as clostridia are normally found in the soil where they can remain indefinitely in a resting stage. As they multiply only in the absence of oxygen or air, they are invariably referred to as anaerobic bacteria.

Diseases caused by this group of bacteria can occur both in man and in animals. Sheep are peculiarly prone to them and they are of economic importance in most sheep rearing and feeding areas throughout the world. One significant characteristic is the rapid course of any clostridial disease leading quickly and inevitably to death of the affected animal. Indeed in most cases animals are rarely seen ill but are usually found dead.

Death is due to the effect of certain poisons called toxins: these are produced by the bacteria while they are rapidly multiplying at the site of infection. Some of these toxins are among the most lethal substances known to medical and veterinary science. Even if symptoms are visible in affected animals it is rare for counter measures, however speedily applied, to be successful in preventing death.

Fortunately there are satisfactory methods of protecting both man and and animals against diseases caused by clostridia. Such methods depend on the presence in the blood serum of persons or animals at risk to a particular clostridial disease an adequate amount of antitoxin specific to the particular toxin or toxins, when it is possible for them to survive exposure to such an infection.

The diseases and their distribution

In Britain there are seven different members of the clostridial group of bacteria that can cause disease in sheep of widely varying ages and breeds. Some of the diseases have definite geographical distribution and are subject

to climatic and other influences. In some circumstances management can play a significant part in the incidence and control of the disease.

Many of these diseases have been known for a long time—indeed it is likely that James Hogg, the Ettrick shepherd, encountered in the flocks of his time the conditions we know now as pulpy kidney disease and lamb dysentery. However, it is only within the last forty years that major advances have occurred both in the understanding of the specific causes of these diseases and in the development of effective means of controlling them.

For example, during the period 1925-35 in Britain workers such as Dalling, McEwen and Wilsdon did much to isolate, identify and classify the specific causes of lamb dysentery, struck and pulpy kidney disease. During the same period in Australia, masterly descriptions were given of the nature and origin of pulpy kidney disease and black disease in that country by Bennetts and Turner respectively.

From this impetus eventually came a clearer understanding of the diseases caused by clostridia, the close relationship between them in their occurrence, the mechanism of the infection, what animals were at risk and how they might be protected

Pulpy kidney disease

Probably the most important single disease in this group is pulpy kidney disease, so called because of the lesions frequently found at post-mortem in sheep dead from this infection. The causal bacterium (*Clostridium welchii* type D) settles in the small intestine of the affected sheep after having been picked up at some time during grazing. In certain circumstances often associated with sudden dietary or management changes, it multiplies rapidly and produces its highly lethal toxin. This is absorbed into the blood stream and death follows extremely quickly. This condition is termed enterotoxaemia.

It is certain that many apparently normal sheep and lambs can harbour *Cl. welchii* type D in their intestines without any obvious ill-effect. However, if these animals are subjected to changes as already indicated then death can occur suddenly and without warning. As sheep of all ages can be regarded as being at risk and, since it is invariably animals in thriving condition that succumb, the economic importance of pulpy kidney disease is readily recognized.

Lamb dysentery and struck

Similarly both lamb dysentery and struck can be regarded as forms of enterotoxaemia because, although they have a separate and distinct cause, in each case the causal organism multiplies in the small intestine. Lamb dysentery is caused by *Cl. welchii* type B, and, as the name implies, occurs only in young lambs and rarely, if ever, after their second week of life. Although this disease occurs mostly in certain hill areas of England, Scotland and Wales, it is also known in lowland flocks. Young suckling beef calves have also occasionally been affected. On the other hand, the disease known as struck is caused by *Cl. welchii* type C, which has a very limited distribution in England and Wales; it was first identified in sheep dying in the Romney Marsh area of Kent. Normally only adult sheep are affected.

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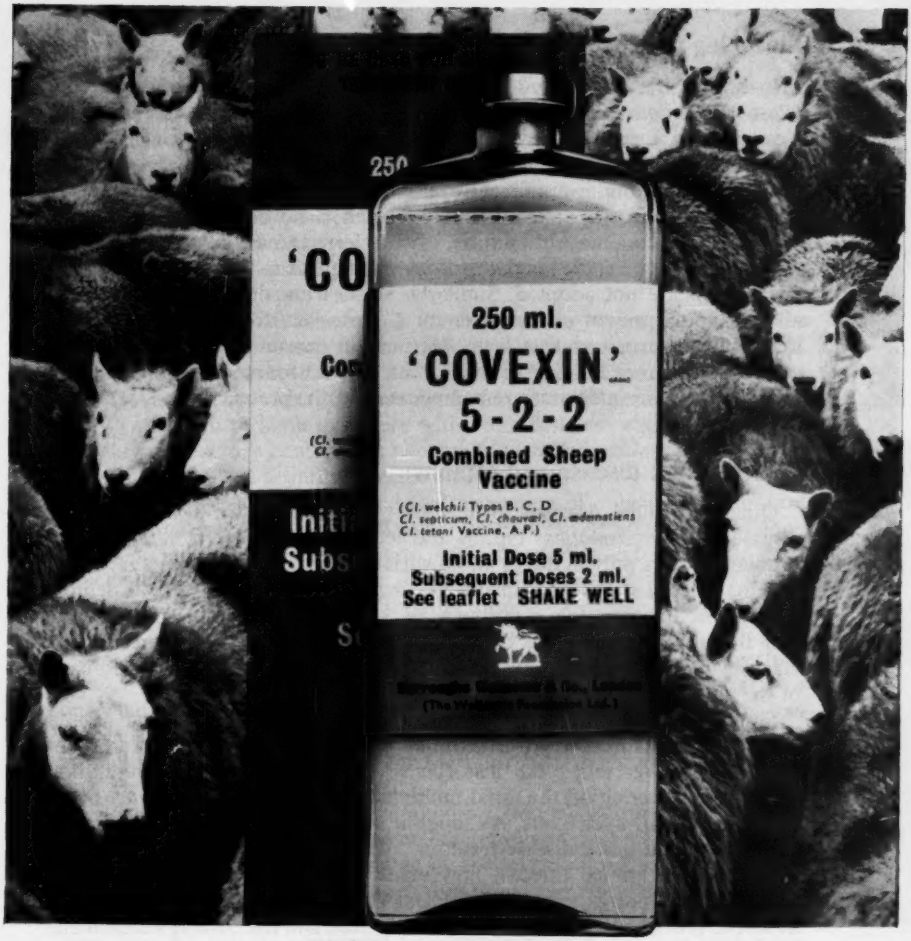

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Black leg

In both cattle and sheep, losses can occur as a result of infection with *Clostridium chauvoei*, this bacterium causing a condition like gas-gangrene. Young cattle and sheep may be affected with what is often called 'blackleg', when the fleshy parts of their limbs become gaseous and degenerate, with death soon resulting. Ewes may also succumb to infection with this organism, for example, after a difficult lambing when the womb readily becomes diseased. This condition of metritis, often referred to as 'inflammation', can sometimes assume epidemic proportions if adequate methods of hygiene and disinfection are not adopted. Similarly, at shearing time, any skin or flesh abrasion may present an easy site for *Cl. chauvoei* to become established if the disease exists on that farm. Here again careful attention to hygiene and disinfection of holding pens etc., can help to reduce losses. Sometimes these gangrenous infections are complicated by the presence of *Cl. septicum.*

Braxy, black disease and tetanus

Other clostridial diseases include braxy caused by *Cl. septicum*, black disease by *Cl. oedematiens* type B and tetanus caused by *Cl. tetani.* Braxy normally occurs only in hoggs and invariably during the autumn and winter months in certain hill and upland grazings. There appears to be a definite association between the occurrence of white hoar frost on the herbage and the appearance of the disease, presumably because of some curious effect by ingested frosted food on the bacteria present in the fourth stomach of the affected sheep.

Similarly, black disease has a definite relationship to environment and climate, being associated with the migration through the liver of a sheep of the parasite liver fluke, the disturbance caused by such fluke migration frequently triggering off the rapid multiplication of any *Cl. oedematiens* type B present in that liver tissue. Although it is possible for liver fluke infection to exist without black disease resulting, it is rare for the converse to occur. Therefore, the annual forecast now made by the Ministry of Agriculture, Fisheries and Food experts at the Central Veterinary Laboratory, Weybridge, as to the probable severity of liver fluke infection in the ensuing autumn and winter months, is of considerable assistance in predicting the likely incidence of black disease. As cattle are also subject to liver fluke infection, losses due to black disease can occur in these animals.

Tetanus has long been known as an insidious condition following injury, particularly deep and lacerated wounds. It has shown an increasing incidence in lambs during the last two decades and seems to be associated with the use of the elastrator method of castration and tailing.

Losses in cattle can and do occur because of infection with various clostridial organisms but they are fortunately much less frequent and widespread than in sheep. As indicated, infection with *Cl. chauvoei* can be a problem on some farms, and black disease can be a hazard in beef-rearing herds in various upland areas. Isolated cases of enterotoxaemia due to infection with either *Cl. welchii* type B (in young suckling calves) and *Cl. welchii* type D (in older animals) have been recorded and there is evidence of the involvement of *Cl. oedematiens* infection in sudden losses in beef cattle being intensively reared. Cases of tetanus are also known, again associated with some form of wounding.

Methods of control: past and present

With the greater understanding of the nature of all these diseases and the importance of the specific lethal toxins produced by these various bacteria, there came an indication of ways to protect livestock against them. By drawing on the experience of medical workers in preventing diseases such as tetanus and diphtheria in man, production began of various antisera (antitoxins) that could be used to provide immediate protection in the event of an outbreak. These antitoxins were prepared from the blood serum of horses actively immunized to a high degree against the specific bacterial toxins.

For example, the introduction of lamb dysentery serum into hill flocks in the Border area between England and Scotland during the 1930s at last made it possible for most of the lambs born there to be reared. Before that time it was not uncommon in some flocks for 40 or 50 per cent of all lambs born to succumb to lamb dysentery within the first two weeks of life.

Highly satisfactory control was eventually provided against pulpy kidney disease by the use of a similar specific antiserum.

However, it was soon recognized that protection of only a short duration could be achieved by the use of such substances. Although this is long enough to give adequate protection against lamb dysentery and to give immediate control of an outbreak of pulpy kidney disease, problems would arise if a further outbreak of the latter disease occurred several months later.

The possibility of vaccinating sheep and cattle against these various diseases was fortunately also studied and, although early vaccines were somewhat crude and not always fully effective, sufficient evidence was obtained to show that, in the long term, vaccination would be the most satisfactory method of providing long-term protection for entire flocks and herds.

This method is known as active immunization since it provokes the production of antitoxin in the blood serum, thereby giving a much more persistent level of protection than is obtainable by the injection of specific antiserum, which provides passive (i.e., short duration) immunity only. Normally, two injections of vaccine are required initially to establish active immunity. Thereafter this can be reinforced by a single booster injection even when given many months after the first two injections.

Two significant facts emerged in the early studies of the use of clostridial vaccines. One was the ability of the ewe, actively immunized during pregnancy by injections of the appropriate vaccine, to transmit via her first milk, i.e., the colostrum, substantial amounts of antitoxin to her lamb. The other was that this antitoxin, though being similar to the serum obtained by immunizing horses, provided a much longer period of passive immunity than did horse serum injected at birth, for example, to protect lambs against lamb dysentery.

Flock immunity

Since the end of World War II there have been major improvements in both the efficiency and safety of vaccines, particularly in Britain, New Zealand, Australia and South Africa. Production techniques have been improved and prices have remained steady. Dose volumes have been reduced

and it has proved possible, within the last seven years, to combine together in a single vaccine several or all of the components necessary to immunize sheep simultaneously against the various clostridial diseases likely to occur. At the same time the value of establishing immunity on a flock basis has been recognized. This is done by first actively immunizing the breeding ewes with two injections of vaccine during pregnancy and then giving single booster injections late in subsequent pregnancies. Lambs born to such immunized ewes acquire adequate levels of passive antitoxin as soon as they begin to suckle; there is no transfer of immunity from dam to progeny in utero in sheep.

Provided the ewes have been injected with the appropriate vaccine and the second or booster injection has been given within the last four to six weeks of pregnancy, the transferred immunity is sufficient to protect the lambs against lamb dysentery in early life as well as against tetanus and pulpy kidney disease, which can occur when they are several weeks old. Indeed, of the lambs going for early slaughter, e.g., before sixteen weeks of age, a large proportion will still be adequately protected against pulpy kidney disease. However, if it is intended to keep the lambs on for late fattening or, in the case of females, as flock replacements, it is then necessary to bring them into the flock immunity scheme by injecting them with vaccine, beginning about eight to ten weeks of age. With lambs born to non-immunized ewes, it is possible to begin active immunization very early in life—the first injection of vaccine can be given quite safely to day-old lambs.

So far it has not normally been necessary to institute similar measures of mass immunization in cattle. In herds with specific problems, for example, where the incidence of blackleg is such as to require regular active immunization of calves, vaccine containing protection against *Cl. chauvoei* and *Cl. septicum* is preferred. In some areas the incidence of black disease in cattle has demanded the use of specific vaccine, whereas in some intensively managed herds it has been found advantageous to use vaccine containing *Cl. oedematiens*, *Cl. chauvoei* and *Cl. septicum* components.

Diagnosis

Because of the varied distribution and incidence of clostridial disease in both sheep and cattle it is essential to have a correct diagnosis when such conditions are suspected and certainly in any instance of sudden death. The veterinary surgeon must be consulted without delay and he will carry out the necessary examination to ascertain the likely cause of death. Modern veterinary practice is now well supported by the Veterinary Investigation Service, which provides quick and accurate laboratory examination to confirm diagnosis. With this information, the veterinary surgeon can advise the farmer on the correct vaccine to use and the time to use it. He is well aware of the general disease pattern in the area and can therefore judge more certainly the right approach to the problem. He will also instruct and advise on the correct technique of vaccination so that whatever vaccine is used will give the maximum benefit.

Modern clostridial vaccines are the product of much careful research and development. They have almost completely replaced serum therapy and, with their wide range of prolonged protection they have given the livestock owner an effective weapon against this significant group of diseases. Properly used they can save him much distress and economic loss.

Planting Potatoes by Machine

R. H. Jarvis, *Terrington Experimental Husbandry Farm*

THE days of hand-planted potato crops are rapidly passing. Mechanical planting offers a saving in labour and an increased rate of work, and it may also enable a farmer who can no longer obtain casual labour to continue to maintain his acreage of this crop.

Types of planter

The potato planter most commonly found on farms in Britain is of the hand-fed type. Seed tubers, placed one by one into cups on a wheel or endless belt, are carried down into a furrow opened by a coulter or planting shoe. These machines will plant sprouted seed with a minimum of damage to the sprouts, but they are not without their disadvantages. In the first place, one operator is required for each row; secondly, the speed of forward travel is limited by the rate at which the operators can fill the cups. Because of this the rate of work varies with the spacing of the setts in the row, and at very close spacings progress may become painfully slow.

In recent years an increasing number of 'automatic' potato planters has been imported from the Continent. Seed for each row is carried in a hopper which is divided transversely by a sliding partition. Seed is placed in the rear portion of the hopper and the slide adjusted vertically so that a few tubers at a time can move under it into the front part, where they are picked up by cups mounted on an endless chain. This may be regarded as the 'principal feed', but it is not the only one, for it is supported by an automatic 'corrector' mechanism. Above and in front of the main hopper is a circular magazine divided into 12–20 compartments each of which holds one tuber. As the seed tubers are carried up by the cups of the principal feed, each touches a sensing wheel or finger which, if it encounters an empty cup, will fall to a lower level than if the cup carried a sett. When this happens a mechanism is activated which causes the corrector magazine to move round one compartment, so that the tuber from this compartment falls into the empty cup, which at this stage is passing immediately beneath it. On a two-row machine it is the responsibility of the tractor driver to fill the corrector mechanism but if more than two rows are being planted they are filled by an operator riding on the planter.

Although machines of this type are widely used on the Continent to plant sprouted seed, many English farmers have experienced difficulty in achieving satisfactory results with them. The most common complaint concerns damage to the sprouts, or even to the seed tubers themselves; it has also sometimes been necessary to replenish the corrector magazine at too frequent

intervals. There is little doubt that most troubles of this type arise through the use of seed which has not been graded to sufficiently fine limits.

Close-graded seed

If closely-graded seed is used the slide which divides the seed hopper can be adjusted so that only a few setts at a time pass under it; in this way they can be picked up by the cups without undue rubbing or damage. But if the seed has not been closely graded, the opening beneath the slide must be wide enough for the largest setts to pass through, with the result that the smaller setts move forward too quickly, giving too many tubers in the front compartment. The movement of the cups through this greater bulk of seed inevitably leads to damage both to the sprouts and to the seed tubers themselves.

The use of close-graded seed is also desirable because cup size can then be made to match sett size, with the result that more cups will carry a single tuber, the number of 'doubles' will be reduced and less use made of the corrector mechanism. Yet a third advantage of close-graded seed (which applies no matter how it is planted) is that recent trial work has shown that setts of different sizes require different spacings in the row. In this way close grading can lead to improved seed utilization and higher profit margins.

In the Netherlands, where automatic planters are used widely, seed is normally split into four grades: 25–28 mm., 28–35 mm., 35–45 mm. and 45–55 mm. The smaller setts command a higher price per ton, and the two middle grades are those commonly used. In this country at present no such system is to be found. The common grade of seed is $1\frac{1}{4}$–$2\frac{1}{4}$ in., although seed graded $1\frac{1}{4}$–2 in. or $1\frac{3}{8}$–$1\frac{7}{8}$ in. can sometimes be bought at a suitable premium. It is now possible to obtain these grades split into two, that is, to buy $1\frac{1}{4}$–2 in. seed split into the fractions $1\frac{1}{4}$–$1\frac{5}{8}$ in. and $1\frac{5}{8}$–2 in. In this case an extra charge is made, usually £2 per ton, and the purchaser will receive his fair share of each of the two grades. This, though clearly a step forward, can only be regarded as an intermediate stage in the development of a differential price structure similar to that operating in the Netherlands.

In spite of these difficulties with purchased seed, a farmer who grows his own can produce a close-graded sample if he wishes, although he may be handicapped by the limitations of his grading machinery. Ideally, three grades, $1\frac{1}{4}$–$1\frac{1}{2}$ in., $1\frac{1}{2}$–$1\frac{3}{4}$ and $1\frac{3}{4}$–2 in., could be selected but a simpler solution, satisfactory with most varieties, is to save only the fraction $1\frac{3}{8}$–$1\frac{3}{4}$ in. for seed. A slightly wider fraction than this may still give satisfactory results with a fairly round variety such as King Edward, but can lead to considerable difficulty with varieties such as Majestic and Pentland Dell, the longer seed being more troublesome. Whatever grade is eventually chosen, the fitting of the correct size of cup and care in the adjustment of the flow between the hoppers will be repaid by a reduction in damage and an increased regularity in the crop.

Sprouting technique

There can be no doubt that the use of closely-graded seed is the most potent single factor contributing to the successful working of Continental-type automatic planters, but it is also important to employ a suitable

sprouting technique. The practice of sprouting seed potatoes has been established in some areas for many years, and there is a considerable mass of experimental evidence to support it. For automatic planters the aim should be to produce sprouts which are about ¼ in. long, tough, and firmly attached to the tuber. Sprout length may be controlled in practice by manipulation of the three environmental factors which govern it—time, temperature and light intensity. Although it is not intended to give an exhaustive list of the various systems of sprouting which have been developed with automatic planters in mind, one or two examples may be helpful.

In the Netherlands a common practice is to store the seed at a low temperature until about three weeks before planting, when it is trayed up and placed in a building with artificial lighting at a temperature of about 50°F. If planting is delayed because of unfavourable weather, the trays are placed outside on trailers, where the lower temperatures and higher light intensity prevent excessive elongation of the sprouts. The trailers are brought under cover if frost is expected.

A second possibility is to stack the trays of seed outside under a transparent polythene sheet for 8–12 weeks before planting, with a thermostatically controlled electric heater to guard against frost. On farms which already have a glass chitting house, satisfactory results can be obtained provided care is taken to supply only the minimum of heat for frost protection but the maximum amount of ventilation. Systems of this type may well give as good results as those obtained from a purpose-built temperature controlled store, but call for more flexible and skilful management.

Possible benefits

It appears then that a farmer who wishes to change from a hand-fed planter to a Continental-type automatic machine must, if he is to obtain satisfactory results, be in a position to provide closely-graded seed which is carrying short, tough sprouts. The potential advantages are considerable. First, the labour requirement at planting time is less. A tractor driver alone can operate a two-row automatic planter and only one additional man is needed if three or more rows are being planted. Secondly, the rate of work will be greater. In the absence of reliable work-study data precise comparisons are difficult. However, a Continental manufacturer who markets both types suggests that a 60 per cent higher output can be obtained from an automatic machine at normal seed spacings. This is probably an underestimate, and makes no allowance for the 'gossip factor' which always tends to reduce work rates when two or more men (or women) are working together.

The double benefit of a lower labour requirement and a higher output is an attractive one in any circumstances, but in the case of potato planting the possibility of improved 'timeliness' is perhaps particularly relevant. There is nowadays an increasing awareness of the importance of the physical condition of the soil in relation to clod-free cultivation and efficient mechanical harvesting. With an improved work rate it should be possible to plant a higher proportion of the crop when soil conditions are really good, so that by using a Continental-type automatic planter it may be possible not only to ease labour problems in the spring but also to lay the foundations for easier mechanical harvesting in the autumn.

Cutting and bagging spring cabbages for London markets

Spring Cabbage

V. F. Grainger

SPRING cabbage is unique among all the field vegetable crops in being almost entirely confined to the British Isles. This is primarily because of the relatively mild winters but also because of the preference for 'green' as opposed to 'white' cabbage. In England and Wales, in spite of the very severe winter 1962–63, over 116,000 tons were produced from 27,400 acres although both these figures were less than the averages for the period 1953–54 to 1962–63 of 170,000 tons and 28,200 acres respectively.

The method of harvesting the crop is subject to the vagaries of the market. In seasons when other brassicae are in short supply, growers may cut a proportion of the more forward plants in the crop for sale as spring greens. The remaining plants are harvested later as hearted cabbage, after winter cabbage has finished and before the advent of summer cabbage.

In Kent, where the area cropped during the 1965–66 season was 4,686 acres, between half and three-quarters of the production is sold as spring greens and a much smaller amount of hearted cabbage is produced. In Cornwall, the crop is grown almost entirely for cutting as spring greens. In Worcestershire, however, in order that they can take the most advantage from the market, many growers prefer to use general purpose varieties.

With the advent of modern herbicides, an increasingly large part of the acreage grown is being direct-drilled in July and cut before the onset of the severest part of the winter.

The grower should choose those varieties best suited to the system of production employed, and it is equally important that a well-tested seed stock of that variety be used. He can then be reasonably sure that it will produce a high proportion of marketable cabbage and a minimum of unproductive plants, such as bolters.

Early-hearted cabbage

Where the aim of the grower is to produce small lightweight early heads of hearted cabbage then the following varieties would be suitable: Harbinger, April and First Crop. All of these are similar in time of heading and are a week or more earlier than most other varieties available to the grower. Their length of cutting period is about a month on average, but in wet seasons, and districts such as the South West, the period may be rather longer. A close watch on their development is required as the heads are very quick to burst if cutting is delayed. The heads weigh slightly less than a pound when cut and trimmed and, because of this, they are not heavy-yielding varieties unless they are grown at close spacings. However, a very high percentage of the plants, almost 90 per cent in some instances, produce good marketable heads, the numbers of bolters being correspondingly low. All these three varieties produce few outer leaves, the heads of Harbinger and First Crop being of a pale yellow-green with prominent veining, whilst heads of April are a rather darker green and the outer leaves reflexed.

The next earliest group of varieties, heading two to three days later than those in the previous group include: Wheeler's Imperial, Early Market and Early Feltham. The cutting period is slightly longer, about 35 days on average. The heads weigh a little more than those of the Harbinger group and average between 1 and 1¼ lb. They also produce a high percentage of marketable cabbage and give moderate to good yields. However, they tend to produce more bolters than other varieties used to produce hearted cabbage. Varieties of the Wheeler's Imperial type show a typical 'propeller' shaped conformation with small, very pointed hearts of a good, dark colour.

The grower sometimes prefers to cut a proportion of the plants for sale as spring greens in January or February and to leave the remaining plants to heart later. Many varieties are suitable for this purpose such as: Myatt's Early Offenham, Hardy Offenham and Durham Early. The time of heading is about a week later than varieties in the Harbinger group and the average cutting period is 40 days. Much selection has been done on the original stock of Myatt's Early Offenham which originated in Worcestershire and has been available to growers over a long period. Varieties in this group produce good yields and high percentages of marketable cabbages and a very low incidence of bolting.

When well grown the heads weigh on average between 1½ and 1¾ lb. Yields are heavy and in some seasons over 20 tons per acre may be harvested. Because many of the varieties in this group produce a considerable amount of outer leaf, they can be cut and marketed as spring greens only if the grower prefers to take advantage of a sudden increase in market price. The heads of Myatt's Early Offenham have solid, broadly-based hearts. The leaves are of pale grey-green or yellow-green with moderately prominent veins and rounded margins. The other varieties also produce solid hearts but the leaves of Durham Early are dark green. There are now also a few 'compact' seed stocks in this group which produce fewer outer leaves.

Spring greens

For the production of spring greens only, varieties producing high, early yields of leafy cabbage are required such as: Scarisbrick Special, Early Giant and Ormskirk Early. The leaves of Scarisbrick Special and Ormskirk Early are rather pale but those of Early Giant are darker.

Varieties also grown for the production of spring greens include: Evesham Early, Newcastle Market and Early Spalding. All these, although later, produce high overall yields.

The following varieties although giving slightly lower overall yields on average, produce greens of good, dark colour: Early Giant, Durham Early and Offenham.

Future trends

As systems of growing and production become more mechanized, varieties producing plants which are more uniform in time of heading will, therefore, be required; those in which a high proportion of the plants produce marketable cabbage will be preferred.

Reference

N.I.A.B. Vegetable Growers' Leaflet No. 7 1966.

This article has been contributed by **V. F. Grainger, Dip. Hort. (Wye),** who is a Technical Officer on the horticultural trials at the National Institute of Agricultural Botany, Cambridge.

An ideal game habitat, different crops, hedgerows and belts

Game in the Seventies

In this article C. L. Coles, Manager of Eley Advisory Station, discusses the future of game, particularly partridges

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PERHAPS the subject most discussed by shooting men today is the decline of the grey partridge. As everyone has his own pet theory, it may be wise

to tread warily. Nevertheless, some of the facts were established by the research undertaken on our experimental estate between 1947 and 1960. The main causes have been stated, perhaps *ad nauseam*, i.e., a combination of bad weather during successive breeding seasons and intensive farming. There may be a third, more mysterious cause, to which I will refer later. Regarding the weather, the crucial period occurs during the main hatch, from 10th to 20th, June and the subsequent days when the chicks are growing. Cold, wet weather at this time will quickly decimate broods—more so when the habitat is unfavourable and, as very few partridges survive more than two breeding seasons, it can be seen that three poor summers in succession will result in a very depleted breeding stock.

The downhill story of the last few years, expressed as pairs per 1,000 acres on the area covered by the National Game Census[1], is as follows:

Year	1961	1962	1963	1964	1965	1966	1967
Partridge pairs (Grey and red-legged combined)	97	87	73	52	55	44	40

As a result of the improved production of young (averaging 3·1 per pair) this year, the spring census in 1968 should certainly show an increase at long last; we may be at the start of an upward trend again.

Although we had a series of unfavourable seasons from 1953 to 1958 (with the exception of 1957 in some areas) the two good years of 1959 and 1960 quickly replenished the stock. On a Wiltshire estate it was found that the partridge populations had increased to a density of a pair to 2·8 acres—a record.

This could happen again, always provided the management was able to take advantage of favourable weather at hatching time. So often keepers are required to spend too much time with reared pheasants, and the essential hedgerow keepering is neglected.

Planning for game

Even during the recent bad years the few estates that had any partridges to shoot were those where the keepers adhered to that almost forgotten art of nest management and, the backbone of game conservation, tunnel trapping. The two are complementary. In addition there was usually sympathetic direction—the game crop and the farming programme being planned and executed together. The only other places that had partridges during the black years were some of the chalk hills, where uncropped, drying-out places were available, all too rare on a heavily fertilized farm, and areas such as artillery ranges, where there was a good pattern of undisturbed, rough grass.

On an intensive farm, with huge fields devoted to single crops, few hedges, constant disturbance from fast vehicles, and a great weight of sprays and seed dressings, the partridge is bound to have a difficult time. Even if the chemicals themselves are non-toxic, they are likely to be of some consequence; the side effects of fewer weeds and insects are not yet known. However, even on the most efficient estates the same argument in favour of game management holds good. Our field advisers have watched the profitability

[1]Carried out jointly by the Game Research Association and ourselves on about 1½ million acres.

of farms going up along with the game bags, although only where the owner is determined to plan for his game as he plans for his barley. A really bleak food factory of a farm, criss-crossed with barbed wire, can be written off not only as a game area but also as a reservoir of most forms of attractive wild life. If, however, a small proportion of the land can be devoted to well-dispersed nesting strips, drying-out places, food patches, shelter belts, game spinneys and so on, the birds will thrive and the capital value of the estate increase. When an estate changes hands, the value of the sporting rights can make a significant difference. The demand for good shooting increases every year.

Although general urbanization, and the speed with which the motorized townsman, plus his wife and dog, can now get to the remotest parts of the countryside, will undoubtedly continue to drain the fields and woods of further gamebirds, I personally believe the worst of the habitat destruction is over. Many farmers are putting back thorn hedges and shelter-belts with advantage. Break crops will relieve the monotony of the cereal prairies, and dipyridyls and direct sod-seeding, if they become popular, will leave more winter cover. Having badly burned our fingers with some of the more lethal seed dressings I think we have all learned that lesson.

The third 'unknown'

To return to the third 'unknown' which may be affecting wild partridges, it must be confessed that on some estates where the management is good and the weather has been kind, as it was in places last year, the young partridges still died off. There was no apparent reason and, where post-mortems were conducted, no obvious signs of disease were present. This makes one wonder whether there is a strange loss of viability due to reasons which at present we know nothing about. Lack of sunshine or some essential nutrients during the parents' and grandparents' lifetime is a possibility. There is also the suggestion that some land which has been heavily stocked for a hundred years may have become 'partridge sick', just as some barley farmers have discovered that one cannot grow cereals continuously without incurring trouble.

Perhaps as one radio character used to say 'The answer lies in the soil'. In a sense the grouse research team in Scotland has proved this. The Americans, with their ideas about pheasants and glaciation, have pursued the same theory for some time. This third unknown will be difficult to investigate, but this is not being ignored.

Of recent years a great deal of work has been carried out at Fordingbridge on the breeding and rearing of partridges for restocking. There is now no difficulty in rearing them in brooders, and advances are being made every year in the production of eggs from penned pairs, particularly redlegs. In the foreseeable future this may become as easy, although it will never be as cheap, as is the management of laying pheasants.

The examination of release and acclimatization methods of the young grey partridges, once reared, is another problem on which our biologist is currently spending a great deal of time and it is hoped that further research will improve the rate of survival. Our own experiments, admittedly with only small groups, have been encouraging, but elsewhere hundreds, even thousands,

of young partridges have been released, of which only a very small percentage are known to have survived.

Redlegs behave differently and offer the possibility of being reared like pheasants and shot in worthwhile numbers in the year of release.

Other species

I have discussed the future of partridges perhaps out of proportion to the amount of time that is devoted to their welfare but I do not want it to be thought that we are not equally concerned with pheasants, wild-fowl and other species.

Many years ago we played a part in pioneering the new pheasant foods and brooder-rearing methods. Later on an interest was taken in adapting modern forestry plantations as improved pheasant habitat. It used to be thought that one had to choose between the birds or the trees. Before the war it was often the birds that had priority; afterwards it was decidedly the trees, and about 90 per cent of them softwoods. But now there is more concentration on planning in a more flexible way and learning how to produce timber, deer, gamebirds and other crops and amenities, in the same woodland areas.

Experiments are also being made with species of pheasants like the Reeves and the Japanese, for regions which are either too wooded or too wet to allow our own native hybrids to be sustained in worthwhile numbers. And for the ordinary pheasant shooter who simply wants his money's worth, investigations are also being made to increase the number of reared birds put in the bag by adopting, as with partridges, more scientific release methods. The Game Research Association's parallel research on pheasant ecology will be of the greatest value in this field.

With regard to wild-fowl we have a broad programme of experimental work covering the increase of mallard, but pintail, tufted and other 'manageable' duck are also included in our studies. As the rearing of mallard is so well understood, although the know-how to make them fly like wild birds is often lacking, we are in the main concentrating our efforts on producing high-density breeding stocks on gravel pits, lakes, farm ponds and other wet land, by using the Dutch nesting baskets and the special techniques they require. Some time ago we immodestly announced that we were the first to develop this system in England by bringing over some Dutch baskets in 1951. It was galling to learn recently that they were in use on the lake in St. James Park in 1665, albeit since forgotten for a century or two! But game management is an old science. Marco Polo planted food patches for game and the Romans reared pheasants quite efficiently. Our own contribution, sponsored by the Eley Ammunition Division, stretches back over thirty-five years.

Wild life research was never more needed than today, though with the active co-operation of the shooting public, I have no doubt that there will be plenty of game in the seventies. Much depends on whether the future generation of landowners, large and small, regard farming as a way of life, with all that it implies—from admiring an unproductive hedgerow elm to sending a subscription to the local Hunt—or whether their precious acres are merely to become their factory floor. If this happens, I may have

done the wrong thing in buying a shotgun that I could not really afford for my 15-year old son. But I believe it to be an investment.

This article has been contributed by **C. L. Coles,** who is manager of the Eley Game Advisory Station, Fordingbridge, Hants. (formerly known as the I.C.I. Game Research Station). Born in Australia in 1917, he has made a special study of game and wild life and it is on these subjects that he is well known as a writer and broadcaster. He has lectured on game in many parts of the world, and in 1963 was Executive President of the International Union of Game Biologists.

in brief

- **Artificial lamb rearing**
- **Coypu and mink: controls continue**
- **Herbage legumes**

Artificial lamb rearing

THIS year will see the construction of a house specially designed for studies of lamb rearing at the Grassland Research Institute, Hurley, in which it will be possible to rear at least 1,600 lambs a year. The breeds to be used will include those noted for prolificacy, such as the Finnish Landrace and its crosses, and those capable of lambing twice a year such as the Dorset Horn.

In point of fact, intensive lamb rearing has been practised at Hurley for the past ten years (500 lambs were so reared last year), but the new concept embodies automatic, electronically controlled, pre-set feeding, a built-in automatic cleansing system operating once every twenty-four hours (or more frequently if found desirable), and the whole needing much less labour than any other lamb rearing system.

The lambs will be removed from their mothers at one day old, and a milk feed presented through pipelines to rows of valve-less rubber teats. The house, divided into four main compartments, will contain 80 pens, each accommodating a maximum of six lambs until six weeks of age. Getting the lambs to take to their ultra-modern 'foster-mother' may well be a problem at first, as it is with all artificial feeding, but the equipment in the Hurley installation has been specially designed to give an easy feed.

Allowing for cleansing routines and rest periods, the building will be capable of handling four or five batches a year, but the actual number will depend on how lambing can be staggered throughout the year.

'It should be borne in mind', said Mr. Colin Spedding of the Grassland Research Institute, 'that the reasons for rearing lambs artificially still apply chiefly to situations where the ewe cannot do the job successfully herself. In the future, however, this may be because of the high stocking rates employed or the large litters being produced, whereas, in the short term, the need is to rear orphans and those lambs which, for one reason or another, would probably die.'

We shall look forward to hearing the results of the trials that are to be carried out to discover the best systems of artificial rearing, both as regards the economics of the job and husbandry practice, that could be translated to a purely commercial undertaking.

Coypu and mink: controls continue

LEGISLATION under which all occupiers must report the presence of any wild or escaped coypus or mink found on their land has been renewed for another five years with effect from 1st January this year. Both species were imported into Britain in 1929 for the establishment of fur farms, the coypu from S. America and the mink from N. America. Subsequent escapes, however, succeeded in setting up wild breeding colonies, which were seen to be causing serious damage to agricultural and fishing interests, and in these circumstances statutory controls were introduced.

In appearance the coypu is a beaver-like animal and when full grown may be about 2 ft long and weigh up to 20 lb. It has prominent, strong, orange-coloured incisor teeth, small ears, webbed hind feet and a round, scaly tail. From about 1939, wild coypus established themselves in various parts of East Anglia. At first, while their numbers were small, their damage to agricultural crops, especially sugar beet, was compensated to some extent by their eating aquatic vegetation and so keeping dykes and other waterways open. But as their numbers increased, their burrowing into dykes and river banks and more extensive damage to crops caused concern and a campaign to contain them within defined areas in the Norfolk Broads was opened in 1962. By the end of 1965 over 136,000 coypus had been killed. Under a Co-ordinating Committee all local interests have combined to try and keep coypu populations in check by patrolling and control work in the likely damage areas. Breeding goes on at all seasons, and two litters a year are usual with an average of five to a litter. There is thus no room for complacency; only vigilance and prompt action will keep them under control.

The mink, a member of the stoat and weasel family, is in its feral state dark brown or almost black, measures about 2 ft from nose to tail and weighs up to 4 lb. Escapes from the 330 licensed mink farms are rare, and the animals are usually recovered. During 1965–67, intensive surveys and trapping were organized. Over 1,000 mink were caught in 1966, and about the same number in 1967.

It is an offence to import and keep coypus and mink except under licence. Special licences are required to import coypus, but mink may continue to be imported under an open general licence on condition that they are kept in escape-proof containers and any escapes in transit are notified to the Agricultural Departments.

Herbage legumes

TRIAL results on red clover, lucerne and white clover are brought together in the new Farmers Leaflet No.4, issued by the National Institute of Agricultural Botany. It also contains brief sections on sainfoin, alsike and trefoil, and shows the relative importance of these legumes. Red clover accounts for about 50 per cent of the herbage legume seed used in this country, compared with 30 per cent for white clover and 3 per cent for lucerne. Reference is made in the red clover section to the results of recent work on varietal resistance to clover rot, and the Swedish late-flowering variety Merkur is listed as resistant.

Lucerne has given higher total annual yields than red clover or sainfoin, due largely to higher production from lucerne in second and subsequent cuts. The French lucerne variety Hybride Milfeuil is listed as a good representative variety for the first time, having averaged 2 per cent higher in yield than Du Puits.

This and other leaflets in the series may be obtained from the Institute's Librarian at Huntingdon Road, Cambridge, price 4*d.* each.

AGRIC

9. Lleyn, Caernarvonshire

M. A. H. Jones

THE Lleyn District extends from the Rivals, the tail end of the Snowdonia range, to Bardsey an island separated from the mainland by the treacherous 'Sound'. The District is a Peninsular extending out to the Irish Sea and is about 10 miles in width. To the south can be seen the panoramic splendour of the Welsh hills which appear to hug the coastline of Cardigan Bay.

Lleyn conjures up thoughts of holidays to countless thousands in Britain, an area of outstanding natural beauty where the urban dweller finds the many beaches and the neighbouring Snowdonia National Park the perfect environment for relaxation. The annual pilgrimage is rather different to that of earlier centuries when the Druids and Saints made regular pilgrimages to Bardsey Island which was at one time the Mecca of Wales. It was here that spiritual solace was sought and where many Saints are said to have been buried. Bardsey Island's claim to fame today is as a bird sanctuary and a tourist attraction.

The tourist industry is of considerable economic value to Lleyn, and numerous smallholdings have survived modern economic pressures due to the additional income derived directly from this booming industry.

Lleyn nevertheless is basically an agricultural area with a preponderance of small family farms. Situated in a lowland area it is covered in parts by a deep layer of boulder clay, glacial sand and gravel ridges of northern origin. Haphazard deposition during the Ice Age has resulted in a diversity of soil types bringing in its wake surface drainage problems and conditions, in more extreme cases favourable to peat formation. At the other end of the scale are those soils which have been classified as suitable for horticultural use.

Common features on farms in the area are the earth banks which form field boundaries and the numerous open ditches which need constant care if they are to remain functional. Modern needs of mechanization rule that the banks are removed and the ditches piped and filled in.

Topography is interrupted by conspicuous igneous masses rising from 1,000 ft to 2,000 ft above sea level. Some of these hills, notably The Rivals, 1,849 ft, has yielded granite of superior quality for many years.

A local quarrying industry and possibly sea fishing activities have been responsible in some areas for the part-time nature of farming and the small size of holdings. The decline in quarrying and fishing has accelerated the amalgamation of these small units.

Lleyn's climate is naturally maritime with an average rainfall of 40 inches. A difference in temperature during midwinter in well-drained soils can be as much as 10°F higher than that in inland areas, an advantage which can be lost under bleak conditions. Recent trends in afforestations make worthwhile contributions in providing valuable shelter in some areas.

The district was traditionally a livestock rearing area, store cattle being sold to graziers in Anglesey and the Midlands. Today the economy is based on milk production, a break with tradition made possible by the establishment of the South Caernarvonshire Creameries in 1938. This creamery is unique in many respects, being the only farmers' co-operative creamery in the country. Since its formation, distribution of profits in the form of a quality payment which usually amounts to twopence per gallon to the producer member is a reflection on a highly efficient organization.

Milk and beef are often complementary enterprises on the same farm. Where units are small, raising the production standards has become a priority and the importation of pure-bred dairy stock from milk producing areas has been one solution. A calf buying group has been formed to acquire heifer calves of a type which will become the nucleus of high-yielding herds.

Progressive milk producers are following national trends in reorganizing their dairy enterprises, herds are increasing in size and labour saving methods are being adopted. Outwintering dairy cows on the drier farms has proved successful, yields have been maintained and labour requirements reduced. Some farmers are exploiting the mild winters which are common to the area by providing, where required, cheap shelters such as the cow kennel.

Beef production from grass is well established. Store cattle that were sold in the past are now fattened at home and the importation of Irish store cattle for grass fattening is becoming more popular on the larger farms. The good liveweight gains made by these cattle ensures a quicker turnover of capital to counteract high farming costs. The Welsh Black Breed, however, continue to be the favourite for meat production in certain areas. Several local pedigree breeders have sold breeding stock to all parts of Britain and to some overseas countries. This breeds' capacity to thrive under rigorous conditions is indeed a notable characteristic.

Sheep enterprises are influenced by the proximity to the hill farms of Snowdonia. Draft ewes are purchased and crossed with Suffolk rams for early fat lamb production. The wintering of ewe lambs from the hill on small lowland dairy farms is another well established practice, but the increasing numbers of cows makes the demand for spring grass more critical and wintering farms are becoming more difficult to find.

Two pig weaner groups have been established in the area. This has been a very popular development amongst many farmers at a time when small scale egg production has become a doubtful proposition. The success of these groups emphasizes the need for a more organized form of marketing of livestock products from a part of the country which is remote from industrial areas.

There is a good potential for early potatoes on the drier farms which could compete with Pembrokeshire for earliness. Present production in the main caters only for local demand.

Cereals grown are normally fed on the farm. Barley is by far the most popular and yields of 2 tons per acre are common on the better land.

Whatever the potentials and opportunities, the younger generation of farmers are showing a readiness to adapt themselves to changing economic conditions, combining good farming with providing hospitality to many holiday makers who see in Lleyn a base for many of the recreational activities from sailing and fishing to pony trekking and climbing.

The Building Regulations 1965

F. W. Holder, *A.L.S. London*

THE Public Health Act 1936 empowered local authorities (except within the administrative area of the former London County Council), to make bye-laws to control the standard of building in England and Wales. These were generally based on model bye-laws issued by the (then) Minister of Health, but in some places they were often varied by Acts of Parliament dealing with local constructional requirements.

In an attempt to achieve uniformity and to take account of changes and improvements in building methods and materials during the intervening years, the Minister of Housing and Local Government took powers under Part II of the Public Health Act 1961 to make 'national' building regulations to replace the old bye-laws and the conglomeration of local practices which had grown up with and around many of them. In 1964, these powers were transferred to the Minister of Public Building and Works, who presided at the birth of the new Building Regulations 1965 (which became operative on the 1st February, 1966). In the same year responsibility for the infant's welfare was transferred back to its natural parent, the Minister of Housing and Local Government, who is now literally, 'carrying the baby'.

Sections 61 and 62 of the Public Health Act 1936 set out matters for which building regulations may be made; for example, as regards buildings, their construction, dimensions, lighting, heating and ventilation; and as regards drainage and sanitation, fire prevention and the administrative procedures relative to notices, inspections and appeals. The new regulations follow broadly the lines of the old bye-laws, but with certain significant differences in respect of new sections dealing with Structural Fire Precautions (Part E), Sound Insulation (Part G) Stairways and Balustrades (Part H), Refuse Disposal (Part J) and Open Spaces (Part K). The inclusion of 'deemed to satisfy' provisions permits the use of materials or techniques covered by British Standard Specifications or Codes of Practice, where these are deemed a suitable alternative to those written into the regulations.

The regulations apply to all new buildings and alterations to existing buildings, except those belonging to the Crown, to schools approved and grant-aided by the Department of Education and Science, to buildings constructed by a County Council or Local Authority in accordance with plans approved by the Minister of Agriculture, Fisheries and Food under the Smallholdings and allotments Acts 1908 to 1931 and any amending Acts, and to buildings belonging to any statutory undertakers and held or used by them for the purpose of their undertaking. This last exemption does not apply to 'dwelling houses, offices or showrooms, other than buildings so used which form part of a railway station'. The exemptions extend also to movable buildings; those connected with mine or quarry workings and accommodation for hop-pickers and other persons engaged temporarily in

agricultural or horticultural activities. Alterations and additions to existing buildings must, with the above exceptions, comply with the regulations and in some instances it may be necessary to bring the existing structures up to the 1965 standard.

The Local Authority is empowered by the Minister to administer the building regulations, and to dispense with or relax any of them with the exception of those in Part A (General) and those relating to Structural Stability (Part D) and Structural Fire Precautions (Part E) (regulation A13) for the relaxation of which the Minister's approval must be sought. Dispensation or relaxation may be granted only for individual jobs (Section 6 (1) of the Public Health Act 1961).

Farm buildings figure in Class 6 of Schedule I of the regulations as 'partially-exempted' buildings described as 'single storey buildings, wholly detached and used exclusively for the storage of plant or machinery, or for the housing of livestock, and wherein the only persons habitually employed are engaged solely in the general care, supervision, regulation, maintenance storage or removal of the materials, products, plant machinery or livestock in the building'.

Buildings in this (partially-exempted) class, are required to comply with a certain number of regulations listed in Schedule I, as follows:

(*a*) *As to Notices* (Regulations A9 and A10)

Regulation A9 requires any person who intends to erect any building; to make structural alterations or extension to a building; to execute any works or install any fittings connected with a building or to make any material change as to its use shall . . . 'give notices and deposit plans, sections, specifications and written particulars in accordance with the relevant rules of Schedule 2'.

Regulation A10 requires the builder to furnish the local authority with written notices, not less than 24 hours in advance of the commencement of certain operational stages of a building and not less than 7 days after completion (or occupation) so that the authority's inspector can visit the premises to satisfy himself that the regulations have been complied with.

(*b*) *As to Materials* (Part B)

Part B is designed to ensure that all materials used in building are satisfactory for the job they do. Regulation BI introduces the 'deemed-to-satisfy' provision to which reference has already been made. Regulation B3 lists a number of materials which are classed as unsuitable in permanent buildings for external walls and roof coverings, and makes conditions regarding the use of others such as thickness of plywood and weight of galvanizing (on steel sheet). New (post-bye-law) materials such as tempered hardboard and asbestos cement sheeting also appear for the first time.

(*c*) *As to Structural Fire Precautions* (Part E)

Farm buildings are required to comply with all the regulations in Part E, except regulation E14 (restriction of spread of flame over surfaces of walls and ceilings). There are 18 regulations in Part E, dealing with such matters as staircases, shafts, compartment walls, fire resisting doors, walls and roofs. Regulation E5 (Fire resistance) lays down standards of performance for different classes of buildings.

The (Second Amendment) Regulations which came into effect in November, 1966, had the effect of modifying regulation E5 so as to remove any requirement for fire resistance in structural frames and certain columns, beams and walls of certain single-storey buildings. This amendment has released farm buildings from a number of onerous restrictions.

(*d*) *As to Open Space around Buildings* (Part K)
Regulation K3 only of this part is mandatory.
This is designed to regulate the open space around buildings in regard to natural lighting and ventilation.

(*e*) *As to Chimneys, Flue Pipes, Hearths and Fireplace Recesses* (Part L).
The Regulations in this part refer to the constructional measures to be taken in all buildings in which heating appliances are installed. They are designed to ensure safety and stability and compliance with Part L in its entirety is necessary for Class 6 buildings.

Part B of Schedule I relates to 'works and fittings' and farm buildings are required to comply with Part M (Heat Producing Appliances), Part N (Drainage, Private Sewers and Cesspools); Part P (Sanitary Conveniences) and Part Q (Ashpits, Wells, Tanks and Cisterns). In practice, some of these regulations may not be applicable, as, for instance, when a farmer disposes of effluent from his buildings (except his dwellings) on to his own land. The Local Authority does, however, have the right to intervene in the event of a nuisance or pollution being caused.

In the early days of 1966 the new Regulations creaked a bit in respect of glasshouses and some authorities were so conscientious in their interpretation of Part E as to restrict the practical value of these buildings. Following representations by the Ministry of Agriculture, Fisheries and Food and the growers' organizations, the Third Amendment Regulations which came into operation on the 15th December, 1967, introduced a new class (7) in the list of partially-exempted buildings in Schedule I. This covers single-storey glasshouses used solely for agriculture as defined in section 221 (1) of the Town and Country Planning Act 1962. Compliance is required only with regulations A9 and A10, BI and B4 (special treatment of softwood in certain areas) and Part L, referred to in connection with Class 6 buildings.

It would be uncharitable to voice criticisms of the new Regulations. Considering that they had to cover subjects which were relatively unknown in 1936, but are now commonplace (central heating and heat and sound insulation are examples) there have, inevitably, been some difficulties of interpretation. These are being overcome by a series of amendments from time to time as experience is gained in working them. The Agricultural Land Service can claim to have initiated some valuable relaxations, with others, it is hoped, to come in the future.

Some of the wording in the Regulations has been described as obscure, and to be comprehended only by lawyers. This, to some extent must be admitted, and interpretation in some obscure rural council may not be quite as erudite or precise as it would be in the gilded halls of a county borough or city. Nevertheless, things like this have a habit of settling into the pattern of life, and if at first the farming world felt that the 'bonds' were tightening, time may show that those who drafted the regulations had some common sense and the farmer may be glad that someone took thought for his personal safety and, in the long term, for his pocket.

Books

Ninety Years of Family Farming. SIR WILLIAM GAVIN. Hutchinson, 1967. 50*s*.

This is a book to be read by all interested in how farming can succeed and why it has succeeded. In form, it is the history of the farms owned and farmed by the Strutt family in Essex and how these grew into one of the largest farming company enterprises in England. It is also the history in epitome of farming in the whole country.

Over the last ninety years farming has twice been brought to near disaster by stop-go Government policy—in the 1880s and for a second time in the 1920s. The normal general history inevitably describes the effect in generalities. In this book you see how the delayed action effect of the repeal of the Corn Laws, with no steps taken to offset it, brought actual disaster to the Essex farmers. The picture is all the more stark on the smaller canvas. The price of wheat fell from 54*s*. a quarter in the seventies to 23*s*. in 1894. Only the courage of Edward Strutt, who took the family farms over from their ruined tenants and farmed the land himself, kept the farms in being. Even he would not have succeeded had he not gone in for business management from the start, long before the N.A.A.S. started teaching this gospel in the last decade. That and large-scale enterprise and the creation of the Terling and Lavenham herds brought the enterprise out of the red and, eventually, well into the black. Equally bold was the decision to break into the retail milk trade—about the only protection a milk producer could have in the days before the Milk Board was set up.

In the twenties came the second disaster. Wheat dropped from 86*s*. a quarter in 1920 to 49*s*. in 1921. Just when the Corn Production Act of 1917 was needed, it was abolished and no other form of farm support took its place. By then, however, the Strutt farms, enlarged by buying other farms in Essex and in Suffolk, could take the strain when other smaller, less well-managed farms again went under. The change of fortune even on the Strutt farms was the more bitter because, throughout the 1914 war when British farms saved the nation from starvation, Edward Strutt had been the Government's Chief Agricultural Adviser and had hoped that they had learnt the lesson that, only at the nation's peril, can you sell British farming down the river.

During the 1939 war the Government went to the Strutt organization again to recruit their Chief Agricultural Adviser and got Sir William Gavin, the author of this book, and an admirable choice. He did not have the same bitter pill to swallow as his predecessor. The lesson had been learned this time. The British farmer who had fed the country in the war was given a policy of farm support. And in the twenty years after 1945, the gross takings of the Strutt farms doubled. Not all of this was the result of farm support. The same skill in management, the same enterprise shows up in the final chapters, with the Lavenham cowtel and the Terling irrigation scheme as leading examples.

This is the story told in this book—the record of what can be done in ninety years and many will profit by reading it.

There are some pleasant sidelines. When the Strutts were producing a succession of the most able managers of farming, they were also breeding scientists of the first order, two fellows of the Royal Society in successive generations. The book has something to say about them and also about the earlier farming activities of the Strutts in Essex.

The whole book makes very good reading, and I warmly recommend it.

J.W.

Nutrition and the Composition of Milk. MANFRED KIRCHGESSNER, HENNING FRIESECKE and GUNTER KOCH. Crosby Lockwood and Son, 1967. 55*s*.

This book, translated from the German, is not one which anyone would want to read, but it catalogues a mass of information. Nearly half of its pages are taken up with more than two thousand references: full titles are given. There are eight chapters, on different aspects of the composition of cow's milk: its fat, protein, carbohydrate, vitamin and mineral content; physical, organoleptic and bacteriological properties; also enzymes and hormones in

milk, and 'anomalous constituents' such as pesticides and radio-isotopes. Successive sections in each chapter are numbered in logical sequence which can nevertheless be confusing, but the 'contents' pages help.

The authors claim not only to describe the effects of nutrition on the composition of milk, but more particularly to discuss the reasons for the changes. In this they hardly succeed. They certainly demonstrate that the reasons are complex, but their description of the effects is often confusing, and the seemingly contradictory results of different experiments are seldom adequately examined. The following sentence is typical: 'The quantity and composition of the roughage, the age and condition of the animals during the dry period, as well as nutrition during the lactation period itself, may be responsible for the different results obtained here'. The intention seems to have been to quote every possible reference from the world literature between about 1905 and 1964, rather than to exercise much critical judgment.

The authors refer to the excessive emphasis which in the past has been placed on milk fat—and their chapter on this constituent is substantially longer than any other and contains something like 800 references. However, they point out that interest is tending to shift to milk protein, which from the point of view of human nutrition is most desirable.

J.P.G.

The Ecology of Insect Populations in Theory and Practice. L. R. CLARK, P. W. GEIER, R. D. HUGHES and R. F. MORRIS. Methuen, 1967. 45*s*.

Ecology is the branch of biology concerned with the relationship between organisms and their environment and is, therefore, highly relevant to agriculture which is concerned primarily with the management of plants and animals, and their surroundings. Insects, both harmful and beneficial ones, are part of the crop and livestock environment which in turn contributes to the insects' environment and they all share the physical and biotic conditions of the place where they happen to be. Man is, of course, a major factor in all this and one of the most important messages of this book is perhaps its emphasis on the need for detailed understanding of the complete interdependence of man and his crops, and the pests that compete for them. Within the narrower field of pest control, it is necessary to understand why and how the numbers of insects fluctuate from time to time and differ from place to place, and this is important for the pests themselves and for their natural enemies. While this statement may seem obvious, the principle has often been overlooked in the search for answers to pest problems. Quick answers obtained empirically are of course necessary, but the search for them and their discovery should not be allowed to obscure the need for much more fundamental, complex and time-consuming research.

The authors of this book are all economic entomologists working in some of the world's most advanced centres of thought in their subject. They describe it as 'an attempt at taking stock of what is understood at present about the population dynamics of insects and the ecological aspects of pest control . . .' and it 'sets out only to outline the development of ecological principles and their application'. These objectives are achieved, but in their statement, the authors do themselves less than justice. Insect ecology has for several years been bedevilled by arguments that have often appeared to be little more than semantic and it is the attempt to clarify these arguments that will be especially welcome to the economic entomologist. But there is far more to it than this, for even more valuable than clarification is the way in which the text indicates how ecological studies can be brought to bear on pest control.

Chapter I discusses current concepts of population and environment and the life system concept that the authors regard as the approach most likely to lead to progress in research. The essential feature of the life system concept is that it does not regard population and environment as separate entities, but as 'complementary elements in a *system*' interacting 'in the ecological events and processes which are involved in the determination of population numbers'. Chapters II and III provide a generalized description of numerical change and current theories to explain insect numbers. Chapter IV deals with the functioning of life systems, drawing on several examples from economic entomology and the remaining chapters discuss the study of natural populations, the ecology of pest control and further development of research on insect populations. There is a comprehensive bibliography.

This is a well-produced book that will be welcomed by students and many others.

F.H.J.

Agricultural Geography. LESLIE SYMONS. Bell and Sons. 1967. 30*s*.

This book is one of a series of advanced economic geographies. The author defines *Agricultural Geography* (p.1) as 'the geography of man's husbandry of the land', and sets out to analyse the factors determining the distribution of agricultural systems by selecting certain regions and crops for detailed study. The book does not claim to be a comprehensive geography of agriculture.

Part I examines the historical, physical, economic and social factors influencing agriculture. Many of the factors are treated cursorily and inadequately, and in some instances are totally misleading in the absence of further qualifications and explanation. A number of the statements made are inaccurate. For example, it is suggested (p. 43), that 'uncontrolled grazing' may cause a pasture to 'degenerate into bog'. On p. 79, writing of cattle, the author states 'Fattening needs feed of high protein level . . .'. Such statements will irritate the informed reader, and detract from the value of the book as a teaching text for either agriculture or geography courses.

Part II discusses systems of exploitation, taking as contrasting examples mixed farming in the British Isles and New Zealand, plantation agriculture in Malaysia, collective farming in the U.S.S.R. and subsistence farming. In places, the writing is involved and the meaning a trifle obscure; a greater use of tables and histograms to present statistics of acreages and yields, etc., would help to emphasize and illustrate some of the points made by the author. In the chapter on subsistence farming, the author's approach is to some extent anthropological and this is one of the most readable chapters of the book.

Part III is concerned with the concepts and methods of regional analysis and one feels that the author is writing with greater fluency than in the two previous sections. The chapter on land utilization discusses a number of land classification systems and should be of particular interest to agriculturists.

All-in-all, a rather disappointing book is marred by errors and mis-statements on agricultural matters. It is to be hoped that its geography is better than its agriculture. Having read the 260 pages of the book, the reviewer—an agriculturist—must admit to still being unclear as to what exactly agricultural geography is all about. The agriculturist no doubt has something to learn from the geographer, and he can certainly benefit from reading this book. Geographers certainly have much to learn about agriculture!

J.L.H.

The Horse in the Furrow. GEORGE EWART EVANS. Faber and Faber, 1967. 12*s*. 6*d*. (paperback).

The tidal wave of mechanization which has swept British farming since World War I has for the most part now relegated the farm horse to purely fringe operations. The old Suffolk horsemen, proud of their skill and jealous of their status in the hierachy of fellow farm workers, wearing their bowler and billycock hats, and smoking their 2½*d*. shag in short clay pipes, would view with dismay the passing of an era when, if the tempo was slower, the link with the land was stronger.

They would take heart, however, to know that Mr. Evans has by this book provided such an excellent memorial to their work and at the same time paid full tribute to the Suffolk Punch. First published in 1960, its availability now in paperback form will surely be welcomed by the student and the general reader alike.

It is a well-authenticated piece of agricultural history of a part of East Anglia in which the heavy yet gentle Suffolk horse was bred and improved to take over from 'the groaning oxen' as lighter ploughs became available and the enclosure movement gathered pace.

Assembled from first-hand information on the old horse-regime, we have here a wealth of detail on the teamster's life and care of his horses, of the high standard and manner of ploughing light and heavy land, and of all the subsequent operations that went to make the horseman's year. The vast store of knowledge, built up over generations, became forged into tradition and, as many an apprentice learned to his cost, this was not something to be lightly acquired or disregarded.

Not the least of the author's researches has been his patient probing into the closely guarded secrets of the Society of Horsemen and 'the power of the horseman's word'. Few were allowed the privilege of membership of this inner brotherhood, but enough evidence has been collected and sifted to show that the practical application of their mysterious power was no old village tale told over a pint at the local. Altogether, this is a well-documented book of unusual interest.

S.R.O'H.

Crop Responses to Water at Different Stages of Growth. Research Review No. 2. P. J. SALTER and J. E. GOODE. Commonwealth Agricultural Bureaux, 1967. 45*s*.

This book is written for the research worker in a specialized field and, quite justifiably, makes no concessions to the ordinary reader. There are no illustrations and few diagrams, just 200 pages of closely reasoned argument on evidence supplied by 1,200 or more published papers covering a carefully defined branch of knowledge.

There are two main parts; one dealing with the responses of annual and biennial crops (written by Salter) and one dealing with perennial crops (written by Goode). The internal structure of these main sections differ somewhat. Whereas the annuals and biennials are discussed crop by crop, the perennial section examines vegetative growth, root growth, flower bud formation, fruit set, etc., and, under each of these headings, deciduous fruit and temperate forest trees (from apples to walnuts) followed by evergreen tropical and subtropical trees and bushes (from avocadoes to tea) with sections on semi-woody and herbaceons perennials (strawberries to pineapples) and on palm trees. A useful introductory chapter frames these sections, defining clearly the scope of the review and the use of terms, and a comprehensive final discussion.

The labour involved in the preparation of such a review is enormous and the task of digesting and presenting it as a coherent whole, formidable. It is by no means merely a bibliography, the commentary and critical appraisal throughout is perceptive and the conclusions which sum up each sub-section, together with the final discussion, give the reader a concise account of the topic as a whole. A welcome feature is the brief appendix in note form which suggests fruitful lines for future research, suggestions which the authors are probably uniquely well qualified to make. They write in conclusion 'It is hoped that this review of the literature, which is by no means exhaustive, will have served a useful purpose if it stimulates ideas on a subject which is not merely of academic interest but has wide agronomic implications'. The papers which they have omitted must indeed be obscure and they should be congratulated on producing what must be a standard reference work for many years to come.

R.S.E.

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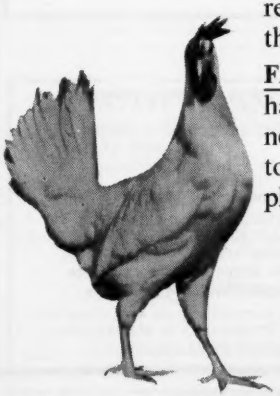

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